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VOL. CXXXVIII.—No. 3584] LONDON: FRIDAY EVENING, SEPTEMBER 5, 1924 [PRICE ONE SHILLING BY ISLAND POST 1s. 3d.

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

MACHINE TOOL AND ENGINEERING EXHIBITION AT OLYMPIA.

The British Empire Exhibition (Twentieth Notice).

The Rugby Wireless Station.

100 Years of British Railways—No. X.

British Association at Toronto.

British Wire-Drawing and Wire-Working Machinery—No. VIII.

PUBLIC NOTICES

RAILWAY MATERIALS FOR SALE.

Sealed Tenders will be received by the Director of Army Contracts for the following RAILWAY MATERIAL :—

AT CATTERICK CAMP, YORKS :
4 Standard-gauge Locomotives and Spares.
3 Passenger Coaches (4-wheel) and Spares.
3 Covered Vans and Spares.
21 W.D. Wagons and Spares.
Permanent Way Material.
Miscellaneous Tools and Plant.

AT CHILWELL, NOTTS :
1 " Baldwin " Locomotive.

AT BRAMLEY, HANTS :
2 " Avonside " Locomotives.

AT WEEDON, NORTHANTS :
1 " Baldwin " Locomotive.

Forms of Tender and further information may be had on application to the DIRECTOR OF ARMY CONTRACTS (D.C. Sales), Caxton House West, Tothill-street, London, S.W. 1. 6754

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, REQUIRES :—

1. MILD STEEL SHEETS.
2. IRON for HORSFALL NUT-MAKING MACHINE.
3. STEEL SHEETS for FLOOR PLATES, 3-16in. thick.
4. PUNKAH MOTORS.

Tenders due on the 19th September, 1924, for No. 1, on the 23rd September, 1924, for No. 2, on the 25th September, 1924, for No. 3, and on the 26th September, 1924, for No. 4.
Tender forms obtainable from above. 6840

Ministry of Transport. The APPOINTMENT of additional ENGINEERING STAFF in the Divisional Offices of the Ministry of Transport situated in London, Edinburgh, Leeds, Birmingham, Exeter, and Cardiff is under consideration.

The appointments to be made are to the grade of Assistant Engineer and probably a few appointments to the grade of Engineering Inspector. The rates of pay are :—

Engineering Inspectors, £400 per annum, rising by annual increments of £25 to £800 per annum.
Assistant Engineers, £300 per annum, rising by annual increments of £20 to £500 per annum.

In addition to the scale stated, the current Civil Service bonus will be paid, giving at present total commencing salaries of about £799 for Engineering Inspectors and about £600 for Assistant Engineers. Bonus is subject to variation in accordance with the variation in the cost of living index figure. The appointments will be permanent and pensionable, subject to a probationary period of two years.

Successful candidates will be appointed at the minimum and will be eligible for promotion on vacancies to the higher posts on the engineering staff of the Roads Department of the Ministry.

Candidates should be Chartered Civil Engineers or should hold some equivalent professional qualification. Previous experience in road and bridge construction is essential. Candidates for Inspectorships should not normally be more than 45 years of age and for the posts of Assistant Engineer not more than 35 years of age.

Preference will be given to men who have served in His Majesty's Forces.

Forms of application can be obtained from the ESTABLISHMENT OFFICER, Ministry of Transport, 6, Whitehall-gardens, London, S.W. 1.

Applications can only be received on the recognised forms and should reach the Ministry of Transport on or before the 20th September, 1924. 6858

Section Engineers Required for the CONSTRUCTION BRANCH of the FEDERATED MALAY STATES RAILWAYS, for four years' service, with possible extension. Salary 400 dollars a month, rising to 475 dollars a month by annual increments of 25 dollars a month, plus a temporary non-pensionable allowance of 10 per cent., which is liable to cancellation or revision, plus a commuted field allowance of 50 dollars a month. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is at present considerably less than that of 2s. 4d. in the United Kingdom. Free passage provided. On expiration of agreement a bonus of six months' salary may be allowed, provided the work and conduct of the person engaged has been in every way satisfactory. Candidates, age 30 to 38 and unmarried, must be fully qualified Railway Engineers, who have received good training and experience on recognised European, American or Colonial Railways. Members or Associate Members of the Institution of Civil Engineers preferred.—Apply at once by letter, stating age, whether married or single, and particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting at top of application M/12,797. 6811

The Polytechnic, 309, Regent-STREET, W. 1.

A SPECIAL COURSE has been arranged for students taking the Studentship Examination of the Institution of Mechanical Engineers, the Preliminary Examination of the Institution of Civil Engineers, and the Final Examination of the Institution of Electrical Engineers (Part 1).

The classes are as follows :—

PURE MATHEMATICS	Monday, 7.30 to 9 p.m.
ENGLISH	Thursday, 6.30 to 8 p.m.
MECHANICS	Thursday, 6 to 9.30 p.m.
FRENCH	Monday, 6.30 to 7.30 p.m.
PHYSICS	Wednesday, 6.30 to 9 p.m.

The syllabus covers all the work in these subjects required for the examinations mentioned.

Fee for the Course £2 2s.

Prospectus free on application to the DIRECTOR OF EDUCATION. 6720

The Polytechnic, 309, Regent-STREET, W. 1.

SCHOOL OF ENGINEERING.

President of the School : The Hon. Sir CHARLES PARSONS, K.C.B., M.A., LL.D., D.Sc., F.R.S., &c.
Head of the Department : ALEX. R. HORNE, O.B.E., B.Sc., (Hons. Eng.), F.R.S. (Edin.), &c.

THE DAY DEPARTMENT

RE-OPENS on SEPTEMBER 16th, 1924. Entrance Examination commences September 9th, 1924, at 9.30 o'clock.

Three-year DIPLOMA COURSES in
MECHANICAL ENGINEERING,
ELECTRICAL ENGINEERING,
MOTOR CAR ENGINEERING.

Practice in the Laboratories, Drawing-offices, Workshop and Field.

Fee 21 Guineas per annum.

THE EVENING DEPARTMENT

RE-OPENS on SEPTEMBER 29th, 1924. Students enrolled from September 17th, 1924.

The Day and Evening Courses are recognised for the Diplomas and Certificates issued by the Institutions of Mechanical and Electrical Engineers in conjunction with the Board of Education.

Full prospectus free on application to the DIRECTOR OF EDUCATION. 6721

The University of Sheffield.

SESSION 1924-25.

Vice-Chancellor : Sir HENRY HADOW, C.B.E., D. Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' courses of study at the University and six months' practice at the works or colliery each year for a period of four years.

The LECTURE COURSES commence OCTOBER 1st, 1924.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 23rd, 1924.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.
6712

Woolwich Polytechnic.

LECTURER REQUIRED, ENGINEERING DEPARTMENT. Graduate with teaching, works, and drawing-office experience; to teach engineering science and drawing, and to lecture on workshop processes. Salary according to Burnham scale.—Particulars from PRINCIPAL. 6731

PUBLIC NOTICES

Cardiff Education Committee.

THE TECHNICAL COLLEGE.

Principal : CHARLES COLES, B.Sc. (Lond.)

DEPARTMENT OF ENGINEERING.

Head of Department : A. W. LOVERIDGE, B.Sc. (Eng.), A.R.C.Sc.

SESSION 1924-25
(Commencing on TUESDAY, 7th OCTOBER, 1924).

The following Courses have been arranged for Engineering Students :—

A Three Years' Course in Mechanical and Marine Engineering, jointly with the University College of South Wales and Monmouthshire.
A Two Years' Course for Apprentices and others with facilities for practical experience in the Summer Term.

These Courses are suitable for students preparing for Degrees in Engineering or for the Examinations of the Engineering Societies.

Special Courses are also arranged for Marine Engineers preparing for the Examinations of the Board of Trade.

OPEN SCHOLARSHIPS, covering tuition fees and maintenance grants of £40 per annum for three years, are offered for competition annually and candidates for entry to the above Department are eligible to compete.

For further particulars of Full-time and Part-time Courses, Entrance Examination, Scholarships, Fees, &c., apply to the Principal. Application forms for Entrance Scholarship Examination, duly filled up, must be received before September 15th.

JOHN J. JACKSON, Director of Education, City Hall, Cardiff. 6770

Technical College, BRADFORD.

FULL-TIME DAY COURSES are provided in the various branches of Technology.

Special facilities are available for advanced study and research.

Further particulars and prospectuses may be obtained on application to the PRINCIPAL, Technical College, Bradford. 6742

University of Manchester.

PHYSICS DEPARTMENT.

Full particulars of the LECTURES and LABORATORY COURSES in PHYSICS, preparing for both the Ordinary and the Honours Degrees, will be forwarded on application to the INTERNAL REGISTRAR. 6727

PUBLIC NOTICES

ENGINEERING AND TECHNICAL OPTICS.

Northampton Polytechnic INSTITUTE, ST. JOHN-STREET, LONDON, E.C. 1.

ENGINEERING DAY COLLEGE.

Full-time Day Courses in the Theory and Practice of Civil, Mechanical, and Electrical Engineering. The Courses in Civil and Mechanical Engineering include specialisation in Automobile and AERONAUTICAL Engineering, and those in Electrical Engineering include specialisation in RADIO-TELEGRAPHY.

The ENTRANCE EXAMINATION will be held on TUESDAY and WEDNESDAY, 23rd and 24th SEPTEMBER. The Courses include periods spent in commercial workshops and extend over four years. They also prepare for the Degree of B.Sc. in Engineering at the University of London. Fees £18 and £13 per annum.

THREE ENTRANCE SCHOLARSHIPS of the value of £62 each for the complete course will be offered for competition at the Entrance Examination.

OPTICAL ENGINEERING AND TECHNICAL OPTICS.

Full and Part-time Courses in this important department of Applied Science are given in specially equipped laboratories and lecture rooms. The Annual Entrance Examination is held in September. All day courses commence on Monday, 29th September.

EVENING TECHNICAL COURSES in all branches of Mechanical and Electrical Engineering commence on Monday, September 22nd, 1924.

The Laboratories, both Mechanical and Electrical, are well equipped with modern apparatus, which, on the mechanical side, provides for specialisation in Automobile and Aeronautical Engineering and, on the electrical side, for specialisation in Alternate and Continuous-current Work, in Radio-telegraphy and Telephony, and in Electrical Testing.

More complete particulars, together with conditions of entrance, &c., and all information respecting the work of the Institute, can be obtained at the Institute or on application to

S. C. LAWS, M.A., M.Sc., Principal.
6321

Administrative County of LONDON.

The London County Council will REQUIRE in October next at the L.C.C. School of Engineering and Navigation, High-street, Poplar, a whole-time TEACHER of MARINE ENGINEERING, capable of preparing candidates for Board of Trade examinations for 2nd class, 1st class, and extra 1st class engineers, surveyorships, 2nd class and 1st class oil motor certificates, and steam certificates for navigating officers. Candidates should possess extra 1st class engineer's Board of Trade certificate, preferably of recent date, and experience in teaching candidates for certificates mentioned above. B.Sc. degree or equivalent desirable. Preference given to candidates who have served or attempted to serve with H.M. Forces.

Scale salary £200-£15-£350, less an abatement of 5 per cent. and subject to any revision on expiration of "Burnham" agreement. Commencing salary according to experience.

Apply, Education Officer (T.1.a.), The County Hall, Westminster Bridge, S.E. 1. Stamped addressed foolscap envelope for form, to be returned not later than 17th September, 1924. Canvassing disqualifies.

JAMES BIRD, Clerk of the London County Council.
6821

Institute of Agricultural Engineering, UNIVERSITY OF OXFORD.

TWO ASSISTANTS are REQUIRED for agricultural engineering research at the above Institute, with specialised training and experience in advanced physics and electrical engineering respectively. The commencing salary will be £300 p.a. and the appointment subject to a probationary period of 6 months.—Further particulars and forms of application may be obtained from the DIRECTOR, 46, St. Giles', Oxford. 6839

Newcastle-upon-Tyne Education COMMITTEE.

RUTHERFORD TECHNICAL COLLEGE.

Principal : C. L. ECLAIR-HEATH, Wh.Sc., A.M.I.M.E.

REQUIRED, as early as possible, LECTURER in ELECTRICAL ENGINEERING for senior work. Candidates should have had good drawing-office and works experience, have received a good technical education in a University or Technical College, and have obtained a University Degree or its equivalent. Teaching experience desirable.

Salary according to Burnham Technical Scale, less 5 per cent.

Applications (on forms to be obtained by sending stamped addressed foolscap envelope), to be returned to the undersigned not later than first post Tuesday 16th September, 1924.

THOS. WALLING, Director of Education.
Education Office, Northumberland-road. 6832

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PUBLIC NOTICES

City of Dundee.

ESPLANADE EXTENSION AND OUTFALL SEWER AT NINEWELLS.

TENDERS are INVITED from competent contractors for the CONSTRUCTION of a SEA WALL or BULWARK extending to 3200ft., and 1000 FEET of BREAKWATER in Rubble; also 1300 FEET of 32in. diameter OUTFALL SEWER, with REINFORCED CONCRETE PILES and GROYNES.

Alternative Offers will be considered for the Construction of the Sea Wall and Breakwater in Mass Concrete from contractors with experience in the design and construction of same.

Copies of the general conditions, specifications, bill of quantities, and form of Tender may be obtained and drawings examined upon application to the undersigned after Saturday, 30th August, on payment of £5 deposit, which will be returned on receipt of a bona fide Tender.

Contractors wishing to be shown over the site of the proposed works are requested to meet the Engineer at Esplanade-road on September 17th at Twelve Noon.

Tenders, sealed and endorsed "Esplanade Extension," to be lodged with the Town Clerk, City Chambers, Dundee, not later than 10 a.m. on Monday, 6th October, 1924.

The Council do not bind themselves to accept the lowest or any Tender.

GEORGE BAXTER, M. Inst. C.E., City Engineer.

City Engineer's Office,
91, Commercial-street, Dundee,
30th August, 1924. 6813

County Borough of Southampton.

RECONSTRUCTION OF COBDEN BRIDGE IN STEEL.

TENDERS are INVITED for the RECONSTRUCTION of the above-mentioned BRIDGE, having five spans of about 75ft. each, including the PROVISION of a TEMPORARY BRIDGE, APPROACHES and all incidental works.

Drawings of the proposed works can be seen at the office of the Engineer for the work, Mr. H. W. Fitzsimons, B.Sc., M. Inst. C.E., 30, Victoria-street, Westminster. Copies of the specification, bill of quantities and form of Tender are to be obtained from the Engineer's office on payment of Five Guineas, which sum will be returned upon receipt of a bona fide Tender and the return of all documents.

Sealed Tenders, endorsed "Cobden Bridge, Steel," must be sent to the Town Clerk, Southampton, not later than Ten o'clock in the forenoon on Monday, the 15th day of September, 1924.

The Corporation do not undertake to accept either the lowest or any Tender.

E. R. LINTHORNE, Town Clerk.

25th August, 1924. 6752

County Borough of Southampton.

RECONSTRUCTION OF COBDEN BRIDGE IN REINFORCED CONCRETE.

TENDERS are INVITED for the RECONSTRUCTION of the above-mentioned BRIDGE, having five spans of about 75ft. each, including the PROVISION of a TEMPORARY BRIDGE, APPROACHES and all incidental works.

Drawings of the proposed works can be seen at the office of the Engineer for the work, Mr. H. W. Fitz-Simons, B.Sc., M. Inst. C.E., 30, Victoria-street, Westminster. Copies of the specification, bill of quantities and form of Tender are to be obtained from the Engineer's office on payment of Five Guineas, which sum will be returned upon receipt of a bona fide Tender and the return of all documents.

Sealed Tenders, endorsed "Cobden Bridge, Concrete," must be sent to the Town Clerk, Southampton, not later than Ten o'clock in the forenoon on Monday the 15th day of September, 1924.

The Corporation do not undertake to accept either the lowest or any Tender.

R. R. LINTHORNE, Town Clerk.

25th August, 1924. 6753

County Borough of Warrington.

KNUTSFORD-ROAD IMPROVEMENTS—BLACK BEAR BRIDGE.

TENDERS are INVITED for the RECONSTRUCTION of the above BRIDGE in REINFORCED CONCRETE crossing the Bridgewater Canal in one span of 28ft., including the PROVISION of APPROACH RETAINING WALL, &c.

Drawings are prepared and can be seen after the 6th inst. at the office of the Engineer for the work, Mr. H. W. Fitzsimons, B.Sc., M. Inst. C.E., 30, Victoria-street, Westminster, S.W. 1. Copies of the specification, bill of quantities, and form of Tender are to be obtained from the Engineer's office on payment of Three Guineas, which sum will be returned upon receipt of a bona fide Tender and the return of all documents.

Tenders are to be sent to the undersigned not later than Noon on Monday, 22nd day of September, and endorsed "Tender for Black Bear Bridge."

The Corporation do not undertake to accept either the lowest or any Tender.

By Order,
A. T. HALLAWAY, Town Clerk.

Town Hall, Warrington. 6850

County Borough of Warrington.

KNUTSFORD-ROAD IMPROVEMENT—RETAINING WALL.

TENDERS are INVITED for the CONSTRUCTION of a PILED RETAINING WALL in REINFORCED CONCRETE about 700ft. long, alongside Knutsford-road and on the bank of the River Mersey.

Drawings are prepared and can be seen after the 6th inst. at the office of the Engineer for the work, Mr. H. W. Fitzsimons, B.Sc., M. Inst. C.E., 30, Victoria-street, Westminster, S.W. 1. Copies of the specification, bill of quantities, and form of Tender are to be obtained from the Engineer's office on payment of Three Guineas, which sum will be returned upon receipt of a bona fide Tender and the return of all documents.

Tenders are to be sent to the undersigned not later than Noon on Monday, 22nd day of September, and endorsed "Tender for Retaining Wall."

The Corporation do not undertake to accept either the lowest or any Tender.

By Order,
A. T. HALLAWAY, Town Clerk.

Town Hall, Warrington. 6851

East Indian Railway.

The Directors are prepared to receive up to 11 a.m. on Wednesday, the 24th instant, TENDERS for the SUPPLY of:—

(1) BOGIE and 4-WHEELED CARRIAGES.

Copies of the specification can be obtained at the Company's office on payment of £1 1s. each. This fee will not be returned.

G. E. LILLIE, Secretary.

73-76, King William-street, London, E.C. 4.
4th September, 1924. 6853

Westbury Urban District and WESTBURY AND WHORWELLSDOWN RURAL DISTRICT.

WATERWORKS WELL.

The Westbury and Dilton Marsh Joint Water Committee is prepared to receive TENDERS for the SINKING of a BRICK-LINED WELL about 110ft. deep, together with ADIT and all APPURTENANT WORKS, at Westbury, Wilts.

Quantites and site plan may be obtained at the office of the Engineers, Messrs. W. H. Radford and Son, Albion Chambers, King-street, Nottingham, on deposit of Two Guineas (cheque), which will be returned on receipt of a bona fide Tender and the return of the quantities.

Sealed Tenders to be delivered to the undersigned on or before Twelve Noon, Friday, September 12th.

The Committee does not bind itself to accept the lowest or any Tender.

By Order,
J. H. H. HILLMAN, Clerk to the Committee.

Westbury, Wilts.
August 29th, 1924. 6762

PUBLIC NOTICES

Port of Bristol.

GRAB HOPPER DREDGER.

The Docks Committee invite TENDERS for the CONSTRUCTION, DELIVERY and MAINTENANCE of a GRAB HOPPER DREDGER with a hopper capacity of 1,000 cu. ft.

N.B.—The Grab Cranes themselves are not included in the contract.

On and after Monday, the 8th day of September, 1924, copies of the specification, &c., can be obtained from the undersigned on production of a receipt to the undersigned showing that a deposit of £5 has been paid to the Bristol Docks Committee, to whom all cheques must be sent and made payable. The deposit will be returned to bona fide tenderers after the receipt of the Tenders with all the prescribed documents and drawings.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Grab Hopper Dredger," and addressed to the General Manager and Secretary of the Docks Committee, 19, Queen-square, Bristol, and must be delivered to him, accompanied by all the prescribed documents and drawings, before 10 a.m. on Monday, the 20th day of October, 1924.

The Docks Committee do not bind themselves to accept the lowest or any Tender.

THOMAS A. PEACE, Chief Engineer.

Chief Engineer's Office,
Avonmouth Dock, Bristol,
27th August, 1924. 6781

State Electricity Commission OF VICTORIA.

MELBOURNE, VICTORIA, AUSTRALIA.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Yallourn Power Scheme.

Copies of Tender form and specification will be available upon application to

Agent-General for Victoria,
Melbourne-place, Strand, London, W.C. 2.

SPECIFICATION NO. 24/88.—66,000-VOLT TRANSFORMERS, INDUCTION REGULATORS AND ACCESSORIES.

CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract and specification complete. This charge will be refunded on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each. This charge is not returnable.

PRELIMINARY DEPOSIT.—A preliminary deposit of £100 is to be lodged with Tender.

The specifications may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on the prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m., 1st December, 1924.

R. LIDDELOW, Secretary.

6779

Worthing Corporation Waterworks.

LONGFURLONG SUPPLY.

TO PIPE FOUNDERS AND PIPE LAYING CONTRACTORS.

CONTRACTS NOS. 3 AND 4.

The Corporation of Worthing invite TENDERS for LAYING about 2 5-8 MILES of 14in., 1 MILE of 9in., and 1 MILE of 6in. CAST IRON SOCKET PIPES and for PROVIDING and LAYING about 500 YARDS of 9in. STONEWARE PIPES (Contract No. 3), and the SUPPLY of about 365 TONS of 14in. dia., 130 TONS of 9in. dia., and 55 TONS of 6in. dia. CAST IRON SOCKET PIPES (Contract No. 4).

Specifications, with form of Tender, general conditions and drawings, in respect of each contract may be inspected and obtained (on payment of Three Guineas, returnable if a bona fide Tender be made), on application at the Water Engineer's Office, Municipal Offices, Tudor Lodge, Chapel-road, Worthing, or at the office of T. and C. Hawksley, Civil Engineers, 34, Old Queen-street, Westminster, S.W. 1, on and after the 30th inst.

Tenders, endorsed "Waterworks," must be delivered at the Municipal Offices at or before Twelve o'clock Noon on Friday, the 19th day of September, 1924.

The Corporation do not pledge themselves to accept the lowest or other Tender.

J. KENNEDY ALLERTON, Town Clerk.

Worthing,
August, 1924. 6758

County of Durham.

APPOINTMENT OF COUNTY SURVEYOR, ENGINEER AND ARCHITECT.

The County Council of Durham are prepared to receive APPLICATIONS for the POSITION of COUNTY SURVEYOR, ENGINEER and ARCHITECT.

The person appointed will be required to devote the whole of his time to the duties of the office, and will not be permitted to undertake any other business. The salary will be at the rate of £1400 per annum, rising by annual increments of £100, subject to satisfactory service, to £1700 per annum.

The appointment will be subject to three calendar months' notice on either side.

Applicants must have special qualifications as to the Construction of Roads and Bridges, and preference will be given to those who are under the age of 45 and who are Corporate Members of the Institution of Civil Engineers.

The appointment is a designated post under the Local Government and Other Officers' Superannuation Act, 1922, which has been adopted by the County Council, and the person appointed will be subject to the provisions of such Act.

All offices, staff, stationery, &c., will be provided by the County Council.

Applications, endorsed "County Surveyor," together with copies of not less than three recent testimonials, to be sent to the undersigned, not later than Wednesday, the 17th September, 1924, from whom a statement of the duties and conditions of the office may be obtained.

Canvassing will be deemed a disqualification.

By Order,
HAROLD JEVONS, Clerk of the County Council.

Shire Hall, Durham,
15th August, 1924. 6692

Singapore, Straits Settlements.

WATER DEPARTMENT.

ASSISTANT ENGINEER.

The Municipal Commissioners of Singapore REQUIRE an ASSISTANT WATER ENGINEER, age 25-30, unmarried, on a four years' agreement, with possible extension. He must have had a good technical education, a regular training as a Civil Engineer, and have a practical knowledge of Surveying, Levelling, and Estimating, and at least three years' experience in works of Water Supply. Preference will be given to an assistant who has passed the examination of the Institution of Civil Engineers as Assoc. M. Inst. C.E. The Testamur by examination of the Institution of Municipal and County Engineers will be an advantage. Salary 6960 dollars for the first, 7440 dollars for the second, 7920 dollars for the third, and 8400 dollars for the fourth year, paid monthly in dollars, the currency of the Colony, the value of the dollar being two shillings and fourpence sterling. The pay of the appointment for the first year at this rate would be £812. Such local transport allowance as may from time to time be sanctioned by the Commissioners will be paid. Free passage will be provided, with half-pay during the voyage out. The selected candidate must pass a medical examination. —Applications, stating whether married or single, age, and place of birth, and giving details of education, training, and experience, particularly in waterworks, and referring to all the above requirements in detail, accompanied by copies (only) of testimonials, and also personal references, to be lodged with Messrs. C. C. LINDSAY and PRIRCE, MM. Inst. C.E., 180, Hope-street, Glasgow, Agents for the Commissioners (who will give further particulars if requested). Not later than Tuesday, 16th September, 1924. 6802

PUBLIC NOTICES

The Great Indian Peninsula Railway Company,

RAILWAY COMPANY, 48, Copthall-avenue, London, E.C. 2, invite TENDERS for:—

1. DRESSED WAGON COVERS ..... Fee £1
2. DRAWN or EXTRUDED BRASS BARS (Brazing Quality) ..... Fee 5s.

Tenders are due by 11 a.m. on 16th September, 1924. Tender forms obtainable at above address. Fees non returnable. 6837

The Joint Committee OF THE COUNTY COUNCIL OF THE COUNTY OF LANARK; TOWN COUNCIL OF THE BURGH OF HAMILTON; and TOWN COUNCIL OF THE BURGH OF MOTHERWELL AND WISHAW.

CLYDE BRIDGE, HAMILTON.

The Joint Committee are prepared to receive TENDERS for the CONSTRUCTION of a BRIDGE about 950ft. in length and 90ft. in width, of independent steel girder spans supported on piers or columns, with exposed facework of masonry, for carrying the public highway leading between Hamilton and Motherwell across the River Clyde, at a point about 120 yards below the present Clyde Bridge. Tenderers will require to submit their own designs.

The Tenders will not include the construction of the roadway forming the approaches to the bridge.

Drawings, showing the data to which Tenders and drawings submitted relative thereto are required to conform, may be inspected, and specifications and forms of Tender obtained on and after 1st September, 1924, on application being made to Messrs. Formans and McCall, C.E., 160, Hope-street, Glasgow. Early application is desirable and no specification will be given out after 30th September, 1924.

For each specification a deposit of £1 1s. will be required, which sum will be returned to the tenderer provided that he shall have sent in a bona fide Tender based on the drawings and specification, provided with a schedule of quantities fully priced out in detail, and shall not have withdrawn same. If competitors desire to obtain a set of drawings these will be supplied by Messrs. Formans and McCall at a charge of half-a-guinea per set.

The employment of labour shall be in accordance with the revised conditions of the Unemployment Grants Committee.

Tenders, on the forms prescribed, together with relative designs and other documents as provided for in the specification, to be enclosed in a securely sealed envelope, endorsed "Tender for Clyde Bridge, Hamilton," and must be lodged with the subscribers not later than Ten o'clock a.m. on the 31st day of December, 1924.

The Joint Committee do not bind themselves to accept the lowest or any Tender.

J. McGHIE,
ROBERT BRYCE WALKER, County Clerks.

County Offices, Hamilton,
25th August, 1924. 6776

SITUATIONS OPEN

WANTED, METALLURGIST and STEEL SMELTER for India, competent to take charge, able to produce any first-class steel. Knowledge of Furnace Repairs essential. Age not over 30. Must have had at least three years' actual charge of electric steel melting furnaces. Commencing salary 500 Rupees per month.—Reply, stating experience, with testimonials, to 884, "Advertiser" Office, Dundee. 6835 A

WANTED, Qualified GAS and MECHANICAL ENGINEER for OIL Works in Esthonia. Applicants must have had good experience in Gas Carbonising and By-product Work or Coke Oven and By-product Work, and to be capable of controlling men. The position would be a progressive one to the right man with the necessary abilities. A man having experience in shale oil production and distillation would be considered.—Write, stating age, salary, and experience, and when at liberty, to Box 853, First-Smith Adv. Service, 66, Finsbury Pavement, E.C. 2. P9521 A

WANTED, to REPRESENT British FIRM in India, fully qualified ENGINEER of good education and address. Preferably with knowledge of Ball and Roller Bearing applications and experience of salesmanship. Single man preferred.—Write, stating salary required, Box M302, Willings, 20, King-street, Covent Garden, W.C. 2. 6848 A

WANTED, YOUNG ENGINEER, Age 24 to 28, for Commercial Engineering, principally sales work, with well-known leading Engineering Company. Applicant must be university graduate, having served apprenticeship course in good engineering works; some commercial experience preferred. Absolutely essential applicant speaks good and fluent French. Position permanent with excellent future for right man, who must comply fully with above requirements. No others need apply. Full particulars of qualifications and references to be submitted with application.—Address, 6845, The Engineer Office. 6845 A

AGRICULTURAL ENGINEERS COST CLERK REQUIRED for Eastern Counties. State qualifications and salary required.—Address, 6716, The Engineer Office. 6716 A

ENGINEER. — REPRESENTATIVE WANTED, London; Cranes, Aerial Ropeways, Handling Plant. Chief qualification the getting of orders. Applications treated in confidence.—Address, stating experience, salary expected, 6833, The Engineer Office. 6833 A

ENGINEER WANTED; Technical and Drawing-office experience, no commercial experience necessary. Opportunity for young man with good future prospects. Commencing salary £250. Invest £1000; 8 per cent. participating preference. Particulars in strict confidence.—"ENGINEER," Box 2834, Bennads Advertising Agency, 24, New Oxford-street, W.C. 1. P9563 A

MACHINE SHOP MANAGER REQUIRED by London Firm of Mechanical Engineers, to Run Machine Shop containing 150 machines on non-repetition work. Experience in similar post essential. Salary £350, rising to £450.—Address, 6817, The Engineer Office. 6817 A

THE SERVICES of a Competent ENGINEER are REQUIRED by old-established Manufacturers of High-speed Reciprocating Steam Engines, to Design and Assist in Developing the Manufacture of Steam Turbines. The modern works are properly equipped for manufacturing and testing electric generating combined plants.—Address, stating age, experience, qualifications, and salary required, 6820, The Engineer Office. 6820 A

WANTED for the North Midlands, DRAUGHTSMEN with experience in Steam Winders design and details, preferably with knowledge of Electric Winders. State age, detailed particulars of experience, and salary required.—Address, 6805, The Engineer Office. 6805 A

WANTED for the North Midlands, a First-class MECHANICAL and STRUCTURAL DRAUGHTSMAN, used to Cement Plant Machinery and Lay-outs.—Address, stating age, details of experience, and salary expected, 6806, The Engineer Office. 6806 A

WANTED, JIG and TOOL DRAUGHTSMAN, with experience in all classes of Tools for Railway Carriage and Wagon Work.—Apply, R. Y. PICKERING and CO., Ltd., Wishaw, Scotland. 6800 A

SITUATIONS OPEN (continued)

REQUIRED

BY A LEADING FIRM OF OIL ENGINE BUILDERS, THE

SERVICES OF AN EXPERIENCED ENGINEER,

TO INAUGURATE A MARINE DEPT

Applicants must have had previous experience in the Design and Installation of Medium-size Plants for Coasting and similar Craft.

Applications will be treated in strictest confidence.

Address, stating age, experience, salary, 6814, The Engineer Office. 6814 A

WANTED, JUNIOR DRAUGHTSMAN for Wagon Work, home and foreign.—Apply, R. Y. PICKERING and CO., Ltd., Wishaw, Scotland. 6801 A

WANTED, TEMPORARY DRAUGHTSMAN. Practical experience in Traction and General Mechanical Engineering essential.—Reply, with references, particulars of experience, technical qualifications wages required, &c., to ENGINEER-IN CHIEF, Power Section, G.P.O., 45, Newgate-street, E.C. 1. 6846 A

ASSISTANT DRAUGHTSMAN, One Used in Marine Engine Auxiliaries preferred. State age, experience, and salary required.—Address, 6745, The Engineer Office. 6745 A

DRAUGHTSMEN.—Aerial Ropeways. First-class MEN WANTED, accustomed to preparing schemes.—Address, stating experience, wages required when free, CHIEF DRAUGHTSMAN, John M Henderson and Co., Ltd., Aberdeen. 6834 A

DRAUGHTSMAN, Not Under Thirty Years of Age. Particulars as to experience and salary.—VAUGHAN CRANE CO., Ltd., Openshaw, Manchester. 6852 A

DRAUGHTSMAN REQUIRED for Design of Paraffin and Semi-Diesel Marine Motors; must have had thorough training and experience.—Address, stating age, details of experience and salary required, &c., H. W. BAMBER, 106, Piccadilly, London, W. 1. 6831 A

DRAUGHTSMAN REQUIRED, Fully Experienced in Steam Wagon Design. State age, experience, and salary required.—Address, P9532, The Engineer Office. P9532 A

DRAUGHTSMAN REQUIRED, with Experience in Commercial Chassis design. London district.—Address, 6844, The Engineer Office. 6844 A

DRAUGHTSMAN (TEMPORARY) WANTED for Constructional Engineer's Office in N.W. London suburb. Experience in work appertaining to buildings of warehouse class, including steel work design and construction. State age, experience, and salary required and when free.—Address, P9535, The Engineer Office. P9535 A

DRAUGHTSMEN WANTED, with Experience on A.C. and D.C. Machines.—State age, salary expected, and earliest commencing date, to NEWTON BROTHERS (Derby), Ltd., Derby. 6828 A

EXPERIENCED DRAUGHTSMAN REQUIRED for London office, with good all-round experience in designing all kinds of Cranes and Lifting Apparatus. Must be quick and accurate.—Apply by letter, giving full particulars of education, training, experience, and salary required, Box 8863, c/o Brown's, 38, Tothill-street, Westminster. 6832 A

EXPERIENCED MECHANICAL and STRUCTURAL DRAUGHTSMAN REQUIRED for London office. Good knowledge of Aerial Ropeway Structures and Machines or similar work an advantage. Must be quick and accurate worker. Good prospects for right man.—Address, giving age, experience, and salary required, 6847, The Engineer Office. 6847 A

FIRST-CLASS STRUCTURAL DRAUGHTSMEN REQUIRED, for North-East Coast. Must have had experience on Heavy Bridge Work, Foundations, Buildings, &c.; designing, preparing drawings for shops and estimating. State salary required. Others need not apply.—Address, 6305, The Engineer Office. 6305 A

FIRST-CLASS STRUCTURAL DRAUGHTSMEN REQUIRED; some but experienced men need apply. State full particulars, age, salary required.—THE CLEVELAND BRIDGE and ENGINEERING CO., Ltd., Darlington. 6799 A

REFRIGERATING DRAUGHTSMAN. — Good DRAUGHTSMAN WANTED for London works; must have extensive experience in Refrigeration; preferably used to designing Compressors.—Write, stating age, experience, and salary required, to Box 1718, Scills Advertising Offices, First-street, E.C. 6809 A

SENIOR DRAUGHTSMAN REQUIRED, London. Experience in all kinds Boiler and Furnace Work. —Address, 6807, The Engineer Office. 6807 A

WANTED, ASSIST. FOREMAN for General Machine Shop manufacturing High-pressure Steam Main Welded Pipes, with experience of Acetylene and Electric Welding, Pipe Bending and Forging; good organiser.—Address, 6840, The Engineer Office. 6840 A

A BRITISH FIRM of GENERAL ENGINEERS in India REQUIRE an ASSISTANT FOREMAN in their Blacksmiths' Shop. Applicants should have had experience in general Smithwork, Drop Forging and Hydraulic Press Work; experience in the manufacture of drums for Lancashire boilers would be a recommendation. Must be a bachelor, age 25 to 28 years.—Apply, stating age and giving full particulars of experience, to K. K. 405, care Deacon's Advertising Offices, Leadenhall-street, London. 6839 A

FOUNDRY FOREMAN WANTED by General Engineering Firm. Applications are invited from keen energetic man not over 35 years of age. Must be fully experienced in all classes of modern foundry work and capable of obtaining maximum output.—Address, stating age, salary required, and fullest details of experience, 6803, The Engineer Office. 6803 A

WORKING FOREMAN for Small Engineering Works near London; must be first-class mechanic, capable of handling modern machine tools and men, producing steam and internal combustion engines. State age, previous experience fully, when at liberty, wages expected. Send photo if possible.—Address, 6826, The Engineer Office. 6826 A

SITUATIONS WANTED

CAPABLE MECH. ENGINEER (27). Late Works manager motor engineering, gear-cutting works, drawings, estimates, keen sales, business man. DESIRES POST req. worker, energy, ability, refinement, excel. refs.—V. M., "Craigie," Bretby, Burton-on-Trent. P9539 B

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

A Large Contract for Glasgow.

IN view of the continued reiteration of the difficulties which beset the efforts of British firms to secure orders in the face of world competition, much satisfaction may be found in the announcement that the generating plant required in connection with the electrification of the Cape Town Suburban Railways is to be made in Great Britain. The orders, which were placed last week by the Electricity Supply Commission of South Africa, were gained in the face of keen foreign and home competition, by James Howden and Co., Limited, and the Mirrlees Watson Company, Limited, both of Glasgow. The consulting engineers to the undertaking are Messrs. Merz and McLellan. There are to be three units, each of which will consist of a 10,000-kilowatt turbo-alternator, complete with surface condensing plant. The turbines will be of Messrs Howden's latest design, and will be coupled direct to English Electric alternators, designed to develop 10,000 kilowatts when running at 3000 revolutions per minute. The alternators are 12,000-volt three-phase 50-cycle machines. All the condensing plant, with its auxiliary pumps, will be supplied by the Mirrlees Watson Company, Limited, under a separate contract. The condensers are to be of the two-flow type, and each unit will be rated for a duty of 104,000 lb. of steam per hour, with a vacuum of 29in. and cooling water at 55 deg. Fah. The surface area of each condenser is 16,600 square feet. Air pumps of Mirrlees steam ejector type will be fitted, each unit having two ejectors, one of ⅓ and one of ⅔ the total air capacity required. Condensate pumps of the firm's patented design for high lifts will be used, and the circulating pump equipment will comprise 27in. and 16in. Mirrlees vertical spindle centrifugal pumps.

The Prevention of Shipyard Accidents.

AN interesting report has been made by the special committee dealing with the prevention of accidents in shipyards. This report, which was issued on Thursday last, states that the best means to secure a reduction in the number of shipyard accidents would be a thorough and systematic course of education whereby the worker would be taught that his own safety and that of his fellow workers were matters of first importance. The evidence submitted to the committee showed that where such schemes had been properly carried out in other industries the percentage of accidents had largely been reduced, and it is recommended that they be applied in shipyards and ship-repairing establishments. The methods to be employed would include the formation of a committee consisting of an equal number of representatives of the employers and the employees, with power to investigate accidents and to report on their cause and any means which might have been adopted for their prevention. A poster service which would stimulate and maintain interest in the dangers of their calling and "Safety First" measures, are also recommended, while more workers and staff, it is stated, should be trained in first aid. The high percentage of accidents in British shipyards is attributed by the committee to the shipyard workers' habit of taking risks. Risks are taken, the report continues, partly out of familiarity with the dangers encountered, partly owing to the lack of proper safety provisions, and partly in the case of pieceworkers to avoid loss of time. The high percentage of accidents among persons under eighteen is a subject of comment by the committee. It is recommended that during the first six months that a young person under sixteen is employed, he should not be allowed to work on the ship or above ground at the side of the ship, and that the employers should make provision for giving him definite instructions concerning the risks he is likely to encounter. During the subsequent six months any such young person required to work on the ship or above ground should be placed in charge of an experienced workman, whose duty it would be to inform him with regard to the safety both of himself and that of his fellow workers.

The Wembley Train Mishap.

A RAILWAY accident, which fortunately was not attended by any serious consequences to the passengers, took place on the Great Central main line from Marylebone shortly after midnight on Saturday evening. At a few hundred yards to the south of West Hampstead Station, the 11.42 train from Wembley was brought to a standstill with the signal against it, whilst immediately behind was a light engine only a few yards from the train. For some unknown cause the 11.52 train from Wembley Hill ran into the engine, forcing it to collide with the first train. The engines were slightly buckled, and some of the coaches in both trains were damaged. A point of interest was that the carriages which were fitted with the new type of buffer arrangements and shock-absorbing corrugated fenders scarcely suffered any damage, whereas some of the old type of carriages without such anti-collision buffers were badly smashed. The anti-collision buffers referred to and the corrugated shock-absorbing fenders were invented and applied to Great Central rolling stock by Mr. J. G. Robinson the late chief mechanical engineer of the Great Central Railway. They formed the subject of an article which appeared in THE ENGINEER of July 1st, 1921.

Carlisle and Belfast Air Service.

IT is reported that work on a new air service terminus near Carlisle will shortly be begun by Northern Air Lines, Limited, of London, with a view to developing an air mail and newspaper service between Carlisle and Belfast. It will be remembered that the same company promoted a scheme for an air service between Manchester, Liverpool and Belfast, but that that scheme had to be abandoned, owing largely to the difficulty of making satisfactory arrangements with regard to aerodromes on the British side. The new project certainly offers a clear cross-Channel route and avoids flight over the Lancashire Hills. It is stated that if the first service is successful a passenger service will follow, and that a Glasgow–Belfast airway may be considered. To begin with, two D.H. 9 aeroplanes are to be used on the Carlisle–Belfast route.

The Euston Fatal Collision Report.

THERE was issued at the end of last week the report by Colonel Pringle on the collision of April 26th at Euston Station, wherein an electrically-operated passenger train ran into a standing excursion train, run from Coventry to London in connection with the Football Association Cup Tie. Five passengers in the latter train were killed and its guard and the motorman of the electric train seriously injured. The cause of the accident was admitted at the time. The signalman had an arriving Scotch express on the up fast line and the special on the up slow. The former train was allowed to proceed, and when it had gone the signalman, from some false mental impression, got it in his mind that it was on the slow line and he "cleared" that line on his block instrument and accepted the electric train. The motorman of the latter could not see the tail of the special as it was under Park-street covered way, which was filled with steam and smoke given off by an outgoing train ascending Camden bank of 1 in 77. As trains standing at the up home signals are in the full view of the signalmen, track circuiting of the lines would not be asked for, but because of the above-mentioned feature at Park-street it is recommended. There was some smouldering in the wreckage, which was put out by extinguishers and again broke out. This was difficult to explain, as it was not due to either escaped gas or short circuiting of the traction currents. It turns out, however, that drippings from the naphtha flares caused it. This has led to a recommendation that acetylene lamps be used. Whilst there was no fire from gas its dangers are pointed out, and a moral drawn from the Bellinzona disaster. The hope is expressed that the proportion of electrically lighted stock—which has grown from 33 per cent. in 1913 to 49 per cent. for the London and North-Western section—will in the future rapidly increase. The necessity for motormen and conductors being educated in the use of the short-circuiting bar on live rails is pointed out, and the report concludes with a well-merited commendation of the ambulance men and the breakdown gang.

Automatic Telephone Exchanges in Spain.

THE Spanish Government is contemplating an improvement of the country's telephone system on a vast scale, and subscribers are looking forward to the use of automatic exchanges. An American-Swedish combine is making a keen bid for the new concessions and has submitted advantageous proposals, but there are several offers from Spaniards to take over the whole business. Generally speaking, the telephone system in Spain has developed fairly well. Every important town and many villages can get through to Madrid without much difficulty. There is also a good line to Paris, and although London cannot be reached, direct communication can, nevertheless, be established. The Spaniards have a system for inland service which proves to be quite useful, namely, the sending of "telefonemas," or written messages, by telephone, these messages being dealt with in exactly the same way as telegrams.

New L.M.S. Steamers.

THE railway and cargo passenger steamer Rye, which was launched from the Dalmuir yard of William Beardmore and Co., Limited, a short time ago, is the third of four steamers which were ordered at the beginning of the year by the London, Midland and Scottish Railway Company. The new boats will be used on the company's service between Goole and the Continent, and they have been mainly designed for cargo and horse-carrying traffic, but comfortable quarters for a small number of passengers are also provided. The following are the principal dimensions of the ship:—Length between perpendiculars, 240ft.; breadth, 34ft.; moulded depth, 16ft. 4in.; with a gross tonnage about 1000 tons and propelling machinery o 1800 indicated horse-power. The first of these ships to reach the launching stage was the Hebble, launched by Messrs. Beardmore on July 7th; the second, the Dearne, was launched by Vickers, Limited, at Barrow on July 31st; and the third, the Rye, was launched at Dalmuir recently, while the fourth ship will take the water at Vickers Yard, Barrow, early in September. There will thus have been within the space of a little over two months four L.M.S. launches. It will also be remembered that another L.M.S. order was recently placed with William Denny and Bros. for a turbine passenger steamer for the company's Clyde service. This vessel is expected to be ready for service next summer. Her principal dimensions are as follows:—Length 250ft., breadth 30ft., and depth 10ft. 6in. The propelling machinery will be triple screw Parsons turbines, designed for a speed of 20¾ knots.

A New Telephone Cable.

THE cable steamer Faraday has just completed the laying of a new submarine telephone cable between Domburg, Holland, and Aldeburg. The cable has sixteen conductors with paper insulation and two lead sheathings, and it will enable twelve conversations to be carried out simultaneously. The weight of the cable is 2150 tons. It was laid from shore to shore without making joints, and it is the first cable of its type to be laid in tidal waters. When the engineering work at the repeater stations is completed and the cable is put into service a great development in traffic will no doubt be experienced. The contract for the cable was placed by the Engineer-in-Chief of the British Post Office on behalf of the associated Governments. The cable ship Faraday was launched at the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited, on February 16th of last year, and was described in THE ENGINEER of March 16th, 1923. It is one of the largest and most modern cable ships afloat.

A Petrol Anniversary.

IT is just twenty-one years ago since bulk cargoes of petrol first began to arrive in this country. The first tanker actually to carry bulk petrol to our shores was the ss. Murex, which arrived in February, 1902; but adequate supplies were only established the following year. It may be recalled that in the early days of the oil tanker such vessels were not allowed to use the Suez Canal, and oil-carrying ships were required to make journeys from Sumatra *viâ* the Cape route. Before the advent of the motor car there was scarcely any demand for petrol, and it was no uncommon practice in Sumatra to pump out the light spirit into the jungle and there burn it to waste. In the year 1903 the total amount of petrol imported was only 33,008 tons, which amount ten years later had increased over tenfold to 342,905 tons. By the end of 1923 a steady yearly increase culminated in the figure of 1,341,564 tons, or about forty times the quantity of petrol which was imported in 1913. In spite of trade depression the petrol trade has still continued to increase and a country-wide system of distribution has been established. The success of the petrol industry has largely depended upon the development of motor transport, but in this direction there remains much to be achieved. At the present time there is in Great Britain one motor vehicle for every forty-three persons, whereas in the United States there is one car for every seven persons. America also uses about twenty times the amount of petrol used in Great Britain.

Giant Submarines.

WHILE the military value of very large submarines is questioned by officers experienced in the handling of underwater craft, several of the principal navies will shortly be reinforced by submarine cruisers, with dimensions greatly in excess of those of any boat now in commission. Our latest submarine, the X1, which is understood to be completing her trials, is shown in the Admiralty publication, "Particulars of British War Vessels," to displace 2780 tons on the surface and 3600 tons when submerged. So far as is known, the X1 is the largest representative of her type hitherto built in Europe, but the French Government is about to place contracts for two submarine cruisers, each with a surface displacement of 3000 tons. Of moderate speed, they are specially designed for habitability and a wide radius of action. In the United States there has just been launched the "fleet submarine" V1, of 2025 tons, the first of a class of three boats built to accompany the battle fleet at sea, for which purpose they will have a speed of 22 knots. Japan is now reported to have acquired certain plans from Professor Oswald Flamm, a well-known German constructor, who has prepared drawings of a 7000-ton submersible, plated with armour and mounting two 8in. guns. That Japan would embark on the construction of such very large vessels, which would be purely experimental in type, is very doubtful, but she is said to have begun work on one or more boats of approximately 3000 tons, which embody the Flamm system of stability and underwater control. This system, according to the inventor, enables heavy weights to be carried on the deck of a submarine without impairing its stability when below water.

The British Empire Exhibition.

ENGINEERING EXHIBITS, No. XX.*

GENERAL ENGINEERING EXHIBITS.

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED.

IN our issue of June 27th we gave an account of the principal electrical exhibits shown at Wembley by the Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, Manchester. Not less

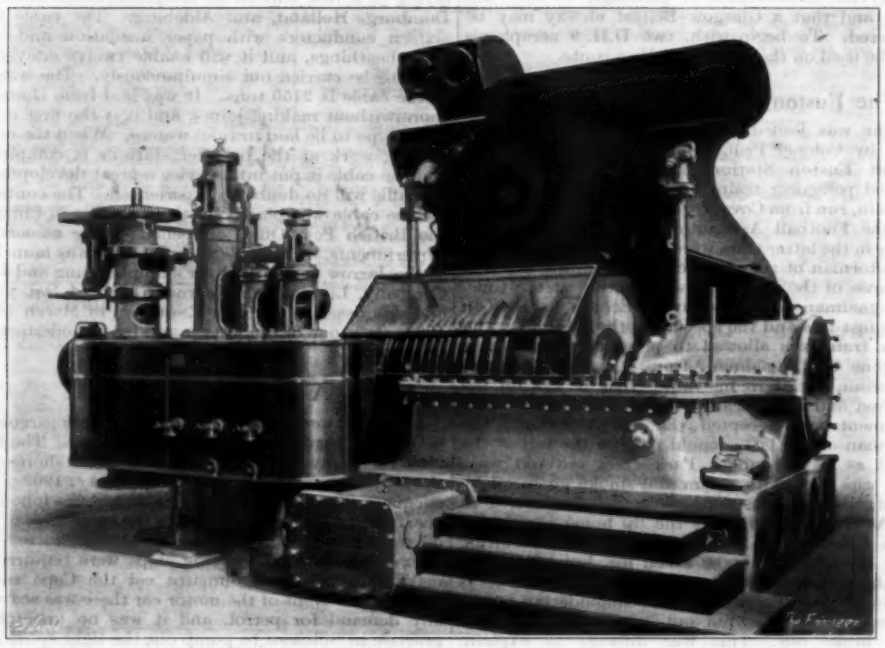


FIG. 392—15,000 K.W. STEAM TURBINE—METROPOLITAN-VICKERS

important than the firm's motors, generators and switchgear are the excellent examples of steam turbines and power station auxiliaries which are shown on the stand. Perhaps the most arresting of these exhibits is that illustrated in Fig. 392, which represents a 15,000-kilowatt steam turbine of the Metropolitan-Vickers Rateau impulse type. It is designed for a speed of 3000 revolutions per minute, with steam at a pressure of 200 lb. per square inch and 220 deg. Fah. superheat and a vacuum of 28½in. As shown above, the top cover of the turbine has been raised and is supported by steel columns in such a manner that not only the rotor but also the nozzles, diaphragms and blading can be examined. The rotor itself is enclosed in a glass case and is driven by a small electric motor, which causes it to rotate at a slow speed. Various parts of the turbine are also illuminated so that close inspection is possible. The rotor is provided with one velocity wheel with two rows of blades, which is followed by nine Rateau stages. After the last Rateau stage there is a by-pass opening for taking steam to the feed-water heater, which is of the integral type and is built in the turbine casing. The steam flows round brass tubes which contain the feed water, and the condensed steam is drained off to the condenser. The remainder of the steam passes through another Rateau stage, after which there are three final Baumann multi-exhaust stages. By means of these last stages the steam is divided into three parts, each of which is expanded down in its own stage to the condenser pressure. This arrangement, it is claimed, enables large outputs at high speeds to be obtained without the use of blades of excessive length or the necessity of using highly stressed discs of large diameter.

The governor valves, which will be seen to the left of the turbine, are of the double-beat type and are arranged to operate in succession, each one admitting steam to one of three groups of nozzles. The valves are actuated by means of oil pressure under the control of a relay mechanism, which is fitted to the first governor valve. The valve operating mechanism is arranged in such a manner that the forces working through the links of the gear are all in one plane, which is the plane of the plungers. The oil supply pump has two compartments, one of which supplies the oil required for lubrication at a pressure of 10 lb. per square inch, while the other provides oil under a working pressure of 60 lb. per square inch, for the governor relay. The coupling between the turbine and the alternator is of the semi-flexible type, which is designed to give the necessary amount of flexibility in order to compensate for very small movements of the rotor and alternator shaft relatively to one another.

The other steam turbine plant exhibited has been specially designed for mill driving and it is illustrated in Fig. 393. It has an output of 1350 brake horse-power at a speed of 4500 revolutions per minute. Its speed is reduced by means of single reduction double helical gearing to 400 revolutions per minute, which is the speed of the long rope drum. An outboard bearing supports the drum shaft, while the turbine pinion is supported on three separate bearings. The method of lubricating the gears by [flooding

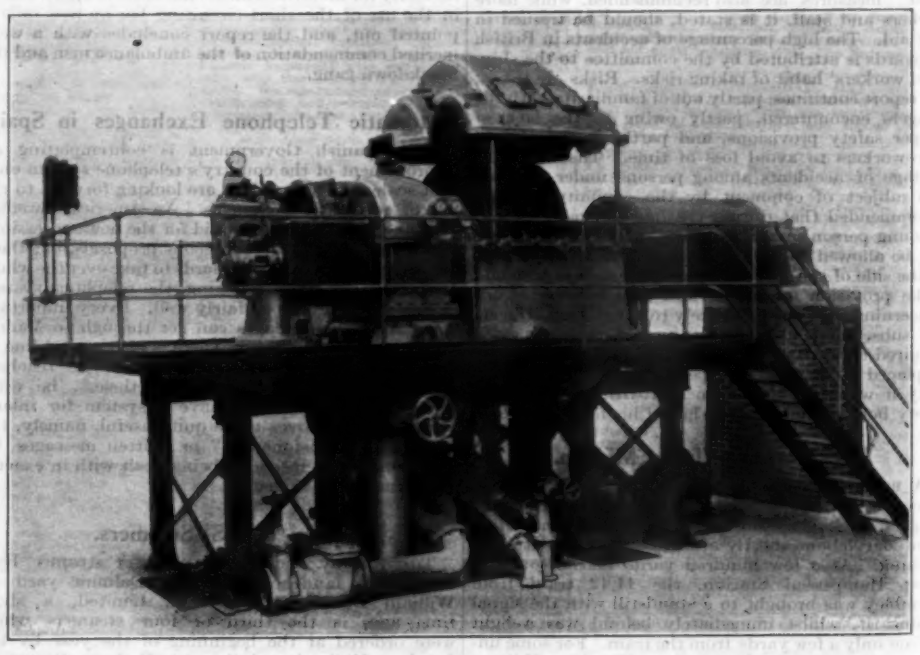


FIG. 393—1350 I.B.H.P. GEARED TURBINE FOR MILL DRIVING—METROPOLITAN-VICKERS

the pinions with oil is clearly shown. A special oil pump placed in the gear-box and driven by a chain supplies the lubricating oil required for the gearing. On this turbine the oil relay plunger forms a part of the governor mechanism, and the plunger motion is counteracted by the movement of a sleeve which the governor operates. Arrangements are made so that different sets of nozzles may be used when running on light loads as desired. The plant is shown complete with a Leblanc jet condenser of neat design. The condenser is placed directly under the turbine exhaust, and it is provided with two lateral circular chambers adjoining the main body, on which automatic vacuum breakers are placed. These chambers greatly increase the water capacity of the condenser and reduce the likelihood of quick flooding should for any reason the water extraction pump fail. The water extraction pump is placed in the lower half of the condenser and is of the duplex type. Alongside and combined with it is the rotary type of Leblanc air pump. All pumps are driven direct from a common shaft, which is provided with a rope pulley driven from the inner end of the main rope driving drum. On the platform near the turbine governor a Scanes vacuum gauge is fitted, which apparatus shows the vacuum under which the plant is working corrected for a 30 inch. barometer. It also indicates the vacuum and condenser efficiency and provides a means of discovering the probable cause of any sudden drop in vacuum.

The Metropolitan-Vickers closed system of alternator ventilation is illustrated by a small-scale working model. A glass-covered section through the foundations of a large turbo-alternator, showing the air passages and a water-cooling device, is reproduced, and the direction of the air currents indicated by ribbons. A separate control board on which is mounted an indicator shows whether the open or closed system of ventilation is being used, and a long distance reading thermometer, the dial of which is also mounted on the control board, indicates the temperature of the ventilating air. Should the water supply to the air cooler—which is installed in a chamber in the foundations and through which the ventilating air passes—be cut off by any cause, the rise in temperature will at once be recorded, and at a certain critical point a visible signal be given by means of a lamp and an auditory signal by means of a Klaxon horn.

It may be noted that although this system has only been a comparatively short time on the market, the equipments which have been installed or which are now on order comprise over 100 turbo-alternators, representing an aggregate of over 750,000 kilowatts capacity. The great advantage of continuously using the same air and cooling it artificially lies in the fact that it is free from dust and moisture, and that its cooling properties are considerably improved.

In addition to the jet condensing plant shown in conjunction with the mill driving turbine already described, a further Metropolitan-Vickers-Leblanc air pump plant driven by a 45 brake horse-power three-phase motor is exhibited. It is connected to a water sealing tank for demonstration purposes and can be shown running under theoretical vacuum conditions and also when drawing up to 30 lb. of free air per hour, under which conditions the degree of vacuum obtained closely approaches the theoretical vacuum.

* No. XIX. appeared August 29th, 1924.

The space occupied by this plant is small, and it is claimed that its volumetric air dealing efficiency is high and practically constant at all degrees of vacuum. The general absence of valves confers reliability and steadiness of running over long periods, it is stated, and the cost of maintenance is practically negligible. Another power-house auxiliary which is mounted near the air pump is the split-casing condensate pump shown in Fig. 394. This represents one of the firm's latest productions and it has been specially designed, we learn, for use in closed feed systems. The improvements in design include the introduction of glands, which are sealed by means of a pressure chamber placed between the gland and the suction chamber, and the provision of renewable impeller neck rings. The pump is furnished with large air freeing connections. As shown in Fig. 394, the upper part of the casing is thrown back so that the internal construction of the pump can be examined. Besides the Leblanc rotary type of air extraction pump the firm is exhibiting an example of the Leblanc steam ejector. The ejector shown is of the two-stage surface intercooler type, and it is designed for the same air duty as the rotary air pump exhibited with it. This latest design of ejector is claimed to have very stable properties throughout its working range, and several similar ejectors are now going through the works.

Besides the large number of Metropolitan-Vickers turbines built for power station and industrial use, the firm has constructed turbines and gearing for marine purposes, and some examples of such productions are shown. One exhibit comprises a rotor spindle of a low-pressure marine turbine fitted with ahead and astern wheels. The shaft is quite complete with its sealing glands and a collar for a Michell type thrust block. A new type of safety governor is also shown, in which weights are used, which when running at excessive speeds are thrown

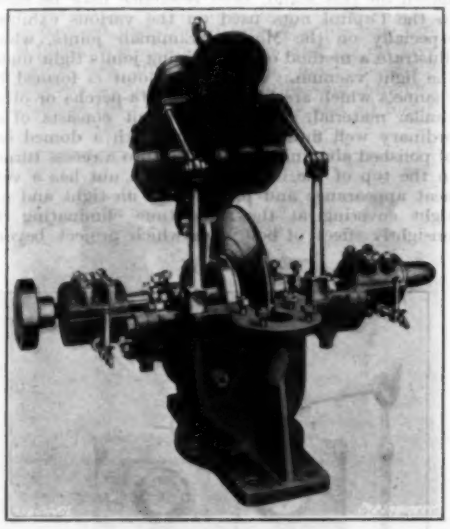


FIG. 394—CONDENSATE PUMP—METRO-VICKERS

out and trip the main steam valve. The rotor referred to is coupled to a gear pinion by means of a claw coupling with a flexible quill drive. We noted the very high finish on the gear teeth, which were untouched by hand and were left with gear-cutting machine finish. The accuracy of gear cutting plays an outstanding part in the success of marine geared turbine installations, and an interesting machine is exhibited by which the accuracy of tooth form and pitch is measured. Some improvements have been made to this machine, which enables it to be used both on large gear wheels and pinions. It may be remarked that the Metropolitan-Vickers Company has not that trouble with marine geared turbine installations which has marred some of the earlier double reduction jobs. A list of the turbines installed by the firm aboard ships is given, and a neatly made model of a marine gear casing fitted with the McAlpine floating type of frame is shown. The object of this special construction is to remove all unnecessary constraint from the pinions and gears and to maintain good running contact and uniform distribution of load along the tooth face in spite of that slight disturbance of alignment which is inseparable from the working of a ship in a heavy seaway.

RICHARDSONS, WESTGARTH AND CO., LIMITED.

The exhibit of Richardsons, Westgarth and Co., Limited, of West Hartlepool, is representative of the firm's various activities in land and marine engineering. One of the prominent features of the stand is a working model of a Richardsons-Tosi marine oil engine cylinder constructed on a two-fifth scale, to the design used for the marine oil engines which the firm has installed on the motorships Sycamore and Tranmore. The cylinder is sectionedin such a way as to illustrate the working of the well-known Tosi exhaust gas inlet valve and director valve gear, and the glandless fuel valve is also shown in section, so that its construction can be easily followed. We reproduce in Fig. 395 a drawing of the cylinder cover and valves, which gives details of the exhaust-inlet and director valves, while the fuel valve already referred to is shown in Fig. 396. Full-sized valves are displayed on the stand. The model has been constructed so that the

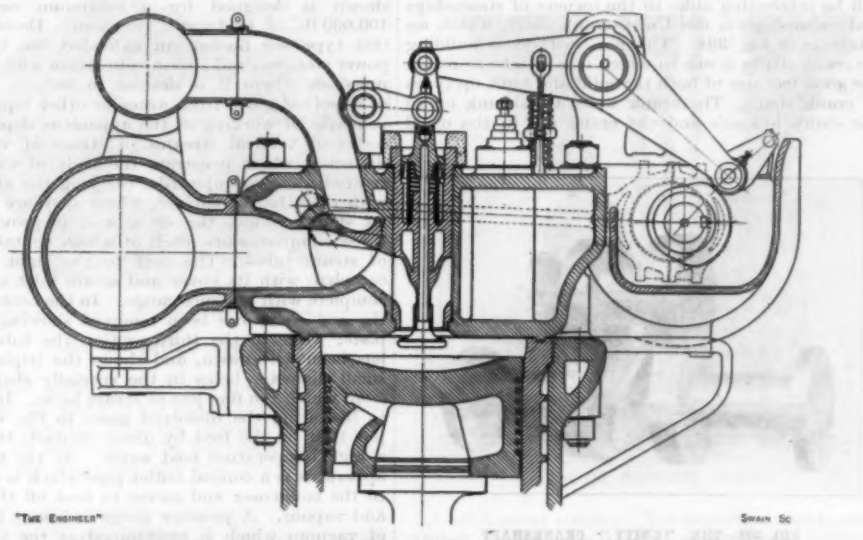


FIG. 395—PART SECTION THROUGH RICHARDSONS-TOSI CYLINDER—RICHARDSONS-WESTGARTH

very simple manner in which the Richardsons-Tosi engine may be started and reversed is made clear.

Another exhibit relating to the firm's activities in motorship construction is a model of the Doxford engine, and a full sized example of the latest type of Doxford control panel which is fitted to all the 3000 brake horse-power Doxford installations, such as the Yngaren, Eknaren, Dominion, Miller, &c. An illustration of this unit is given in Fig. 397. The actual starting operation is carried out by rotating the large hand wheel in the direction the engine may be required to run, namely, to the right-hand for ahead and to the left-hand for astern. Assuming the hand-wheel to be in the stop position the valve gear is placed in the ahead or astern position by moving the

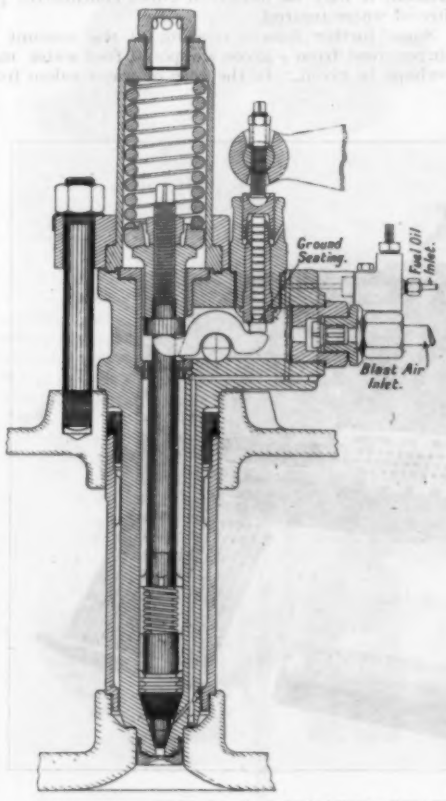


FIG. 396—GLANDLESS FUEL VALVE

side lever, shown to the right of the supporting stool. This reversing lever moves the engine cam shaft in a fore and aft direction, bringing the separate cams provided for ahead and astern running under the rollers of the valve levers. When the starting wheel registers the stop position, the rollers of the levers are lifted clear of the cams. The forward position of the side lever corresponds to the astern direction of running and the back position to that for running in the ahead direction. By means of interlocking gear it is impossible to move this lever unless the starting hand wheel is in the stop position. After the side lever has been correctly placed a small lever, which will be seen at the centre of the unit immediately above the starting wheel, must be pulled downwards so as to release the locking mechanism. The main starting wheel can then be turned, but only in the direction for which the side reversing lever has been set. The starting operation is then carried out by moving the hand wheel from "stop" to "air on" and then on to "fuel." The movements which are made are recorded step by step on the circular dial placed at the top of the control unit. This dial also indicates the position of the valve gear setting, the ahead position being shown in black and the astern position in red letters.

In starting it is customary to give a slight pause in the starting air position and then to move the wheel smartly over to the fuel position, as dictated by the engine-room telegraph. The same hand wheel also controls the lift and timing of the fuel valves, which are indicated on the dial.

For use at sea when the vessel is running under steady conditions a centre locking wheel is provided

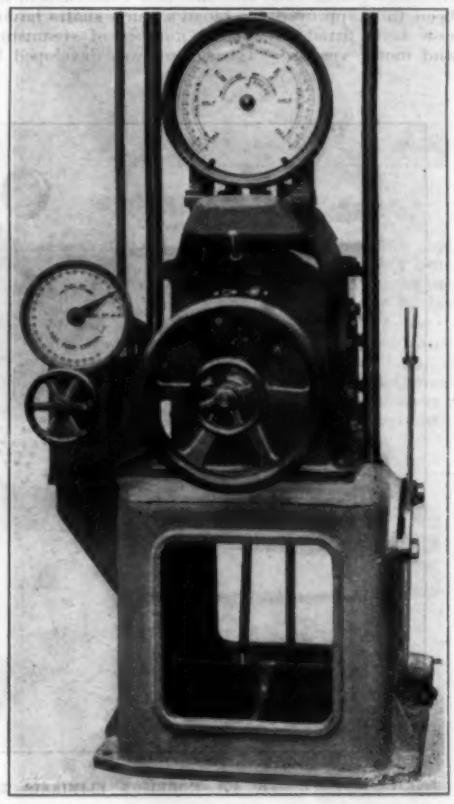


FIG. 397—DOXFORD CONTROL PANEL

which fixes the position of the fuel valve gear. At the left-hand side of the unit is another small hand wheel which controls the amount of lift given to the fuel pump suction valves, so determining the amount of oil which is delivered to the engine cylinders. The pump output is recorded on a dial placed above the aforementioned wheel, and this dial gives to the engine attendant an accurate indication of the working conditions of the pump and the engine at any given load. A feature of the control gear is its absolute simplicity. It is, moreover, very

compact in its construction, and it eliminates, to a very large extent, the personal element in the operation of starting up the engines. We may remark that with the system described no servo-motor of any type is used, and that at all times there is a positive connection between the control mechanism and the valve gear.

A new development in marine engineering which will be interesting alike to the owners of steamships and motorships is the Unity crank shaft, which we illustrate in Fig. 398. This new method of building up crank shafts is one in which it is sought to retain the good features of both the solid and built up types of crank shaft. The crank webs are shrunk on to the crank journals and the crank pin in the usual

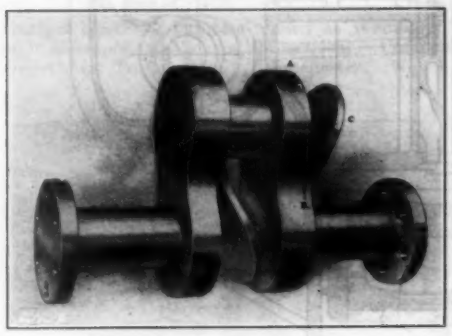


FIG. 398—THE "UNITY" CRANKSHAFT

manner, but at the exposed ends of the journals and the pins a space for welding is recessed out on the outer side of the web in the case of the pin and on the inner side of the web in the case of the journals. It is found that if a shaft is welded in this manner to a depth equal to the diameter of the shaft divided by eight, the unity strength of the shaft for torsion is obtained throughout its length, which is considerably more than that which is usual for the ordinary built-up construction. The shaft exhibited at Wembley has been sawn through at the webs along the section A B, and the solid portion formed by the web and the welded pin C has been turned back for inspection. This thin slab, which has been made integral with the pin by welding, is capable of transmitting the full torsion of the pin to the journal. In the Unity crank shaft a reduced width of web is therefore permissible, and this new construction has been fully approved by Lloyd's, such shafts having now been fitted to a large number of steamships and motor vessels. The system was developed by Mr. D. B. Morison, and Unity crank shafts are manufactured both by Richardsons, Westgarth and Co., Limited, of Hartlepool, and the North-Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne.

Another part of the firm's stand is devoted to the well-known Contraflo marine auxiliaries. These are neatly mounted on steel columns, and are displayed and sectioned in such a way that the details of construction can be studied. The apparatus shown includes a Contraflo auxiliary condenser, a 30-ton marine evaporator, a cascade filter, and a Compactum air ejector, in addition to which there is a surface type feed-water heater designed to work in conjunction with a 1500 indicated horse-power marine steam engine.

Fig. 399 illustrates an exhibit which should be of considerable interest to power station engineers. It comprises a full sized Morison Eliminair De-aerator, similar to five which have been supplied by the firm to the Carville power station of the Newcastle Electric Supply Company. The unit shown is designed for a maximum capacity of 100,000 lb. of feed-water per hour. De-aerators of this type are finding an extended use in electric power stations, and also in connection with industrial processes where it is desired to remove all traces of dissolved gases from water or other liquids. The principle of working of the apparatus depends on a series of vertical streams of steam of very small diameter, which penetrate the body of water to be treated and pass upwards, carrying the air bubbles with them to the surface, where they are liberated. As shown below, the de-aerator is provided with three compartments, each of which contains a nest of steam tubes. The nest to the right is shown complete with its cover and steam inlet connection complete with pressure gauge. In the centre section, the end cover has been removed showing the tube plate, while in the third section the tube element has been withdrawn, and shows the triple series of small diameter holes in the specially shaped tubes from which the fine jets of steam issue. In addition to liberating the dissolved gases in the water, the jets heat up the feed by direct contact, thus giving a high temperature feed water. At the top of the apparatus is a conical outlet pipe which is connected to the condenser and serves to lead off the free air and vapour. A pressure gauge indicates the degree of vacuum which is maintained at the top of the De-aerator. Temperature tubes are provided for taking temperature readings at the three sections. The larger part of the feed heating is done in the first section of the apparatus, after which the other two sections only supply the amount of steam necessary to maintain a temperature corresponding to the working pressure.

The tests carried out by the firm in its own laboratory show, we learn, that the extraction of air is begun immediately the feed enters the water at a temperature of 60 deg. Fah., and it continues to follow practically a straight line law until 99 per cent. of the air present has been driven off. An interesting comparison between the air extracted by heating in a de-aerator and that removed by heating in the ordinary way, is shown by the diagram reproduced in Fig. 400. The quantity of gas released is expressed, it may be noted, in cubic centimetres per litre of water treated.

Some further figures relating to the amount of air removed from a given sample of feed-water may perhaps be given. In the case of water taken from the Hartlepool town supply at a temperature of 45 deg. Fah. before treatment, the amount of dissolved gases present were found to be as follows :—

CO_2, 7.3 ; O, 6.9 ; N, 15.7 ; giving a total of 29.9 cubic centimetres per litre. When the same water was heated before treatment, to 100 deg. Fah., the amounts of gas were reduced as follows :—

CO_2, 6.4 ; O, 4.26 ; N, 14.22 ; total, 24.9. After the heated water was passed through the de-aerator, gas was found to be present in quantity as follows :—

CO_2, 0.41 ; O, 0.07 ; N, 0.55 ; total, 1.03. It was found that the degree of gasification of an original water has very little effect on the final results obtained. Thus, for example, water taken straight from the town main may carry in it as much as 6.9 cubic centimetres per litre of dissolved oxygen, while condensate taken from a surface condenser at 28in. vacuum may only contain 1.95 cubic centimetres per litre, of oxygen dissolved in it. Yet, after passing through the he-aerator both these waters would have a resulting amount of dissolved gas not exceeding about 0.06 to 0.07 cubic centimetres per litre. A working model illustrating the principle employed

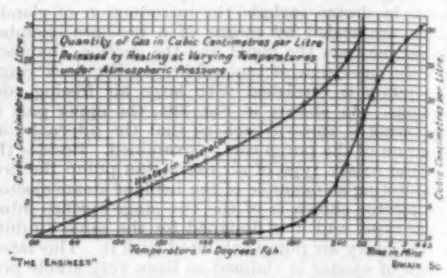

Quantity of Gas in Cubic Centimetres per Litre Released by Heating at Varying Temperatures under Atmospheric Pressure
Cubic Centimetres per Litre
Heated in Eliminair
Temperature in Degrees Fah.
"THE ENGINEER"

FIG. 400—CURVES SHOWING GAS RELEASED

in the Eliminair De-aerator is fixed on the stand, and shows clearly the stream line action the of jets of steam rising through the feed-water.

Other power station auxiliaries include an evaporator designed for an output of 40 tons per hour. It is illustrated in Fig. 401, and is the latest type embodying the firm's most recent practice. New features include self-draining heating coils. The size of this auxiliary for a given output has, we learn, been very much reduced in comparison with the ordinary type of evaporator.

In concluding the description of the apparatus shown on this stand, brief reference may be made to the Capitol nuts used on the various exhibits, especially on the Morison Eliminair joints, which illustrate a method of maintaining joints tight under the light vacuum. The sealing joint is formed by channels which are filled with gutta-percha or other similar material. The Capitol nut consists of an ordinary well finished steel nut with a domed cap of polished aluminium expanded into a recess turned in the top of the nut. The domed nut has a very neat appearance and provides an air-tight and oil-tight covering, at the same time eliminating the unsightly effect of bolt ends which project beyond the nut. It has, we learn, been used on various forms of vacuum and steam apparatus with considerable success, and it certainly imparts a fine finish to any engine or apparatus on which it is employed.

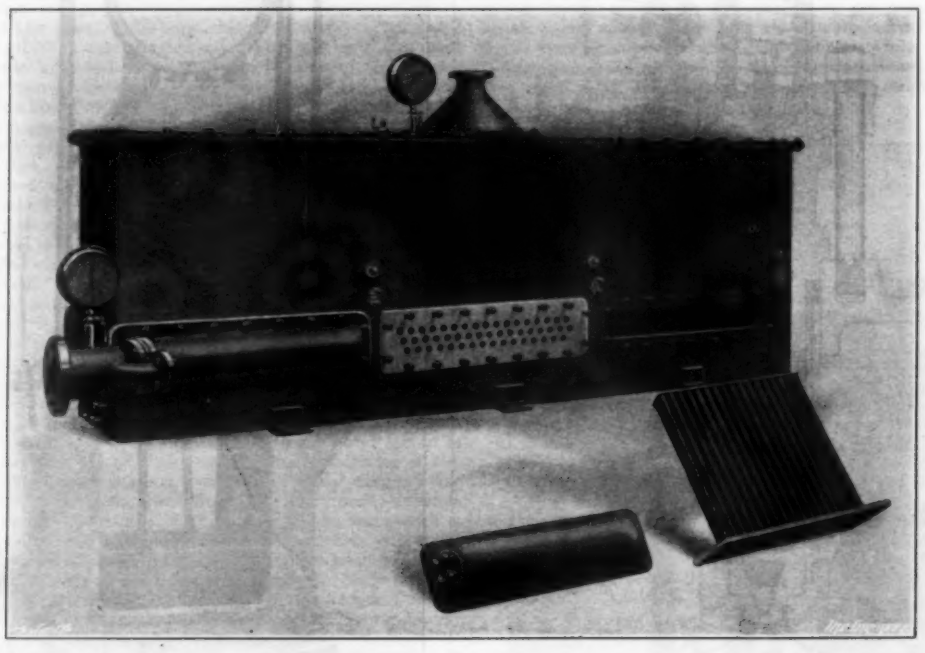


FIG. 399—MORRISON ELIMINAIR DE-AERATOR—RICHARDSONS-WESTGARTH

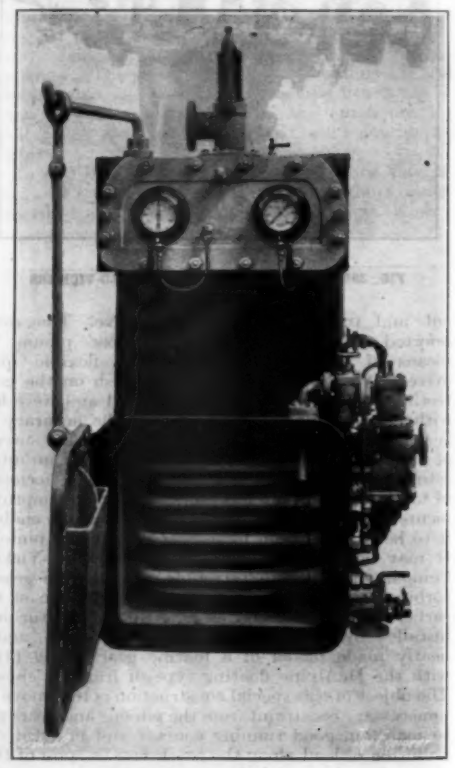


FIG. 401—40-TON EVAPORATOR

ELECTRICAL ENGINEERING EXHIBITS.

THE BRITISH THOMSON-HOUSTON COMPANY.

A large oil immersed 115,000-volt three-phase outdoor circuit breaker is being exhibited by the British Thomson-Houston Company of Rugby. These

circuit breakers, manufactured at the company's Willesden works, are made in two types. In one case finger type contacts are protected by static shields, whilst the other type of switch, which is for a heavy rupturing capacity, is provided with explosion pots. The breaker exhibited at Wembley

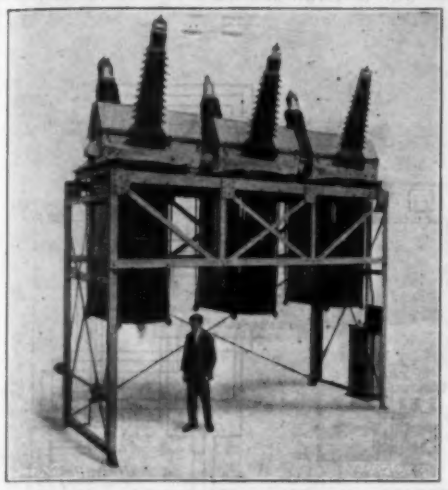


FIG. 402—115,000 VOLT OUTDOOR CIRCUIT BREAKER—B.T.H. CO.

is of the latter type, and is mounted in a frame—as shown in Figs. 402 and 403. The tanks can, of course, be lowered to enable the contacts to be inspected. The breakers are composed of three single units with separate oil tanks, and the units are coupled together to form a triple pole breaker. Oil-filling and draining cocks and an oil level indicator are fitted. Pebble filled oil-separating chambers are provided, and in passing through these chambers the mixture of hot gas and oil formed by

FIG. 403—END VIEW OF CIRCUIT BREAKERS—B.T.H. CO.

the arc is cooled and the gas is separated from the oil. The gas passes to a vent which exhausts outside the switch body, whilst the oil returns to the tank.

The operating mechanism of the breaker—see Figs. 408 and 409—consists of a system of links and levers which are arranged to give a parallel motion to the tension rods and partly toggles in the "on" position, thus relieving the coupling rods of heavy stresses. Easily adjustable accele-

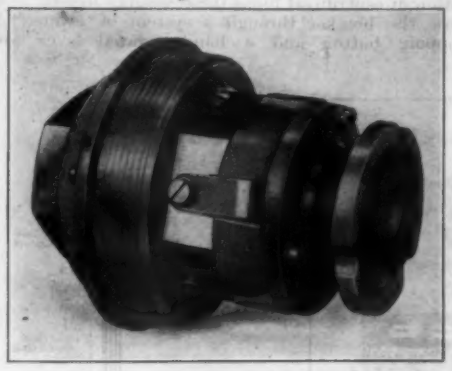


FIG. 404—SWITCH CONTACT

rating and buffer springs are provided, and dashpots take the shock at the end of the opening stroke. All the operating rods are enclosed in waterproof sheaths or housings. The explosion pot type of contact—see Figs. 404 and 405—consists of a self-

FIG. 405—SWITCH CONTACT MOUNTING

aligning socket with renewable sparking contacts, which are enclosed in a steel explosion pot provided with insulated linings and throat bushings, the pot being enclosed within cylindrical insulating shields. The moving contacts—see Figs. 406 and 407—are of

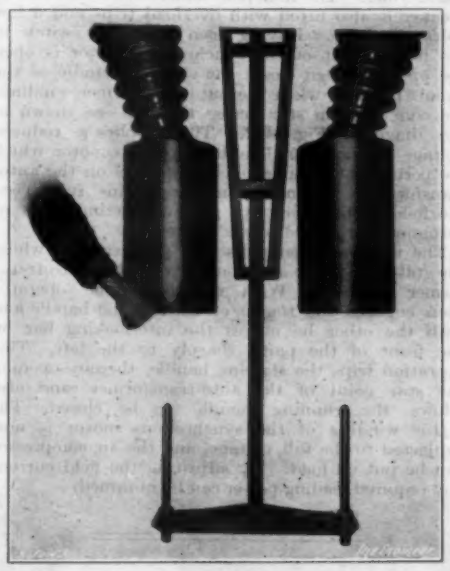


FIG. 406—CONTACTS OPEN

the plug type, and consist of adjustable copper tubes with renewable sparking tips.

The principle of the explosion pot type of contact is well known. It is designed so that when the contacts part, the gas, which is generated at high pressure, forces a stream of oil through the throat of the pot directly into the path of the arc and accelerates the moving contact, confines the damage done by the arc, and relieves the structure of the breaker

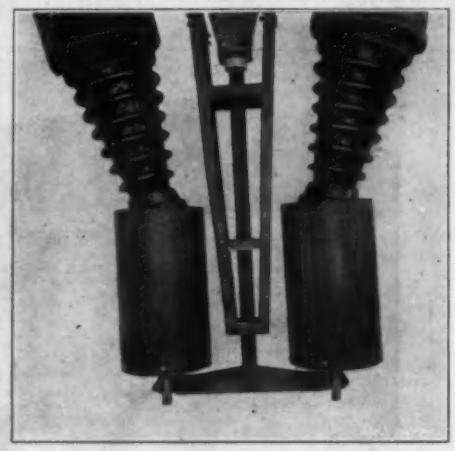


FIG. 407—CONTACTS CLOSED

of mechanical strains. The bushings, which are oil filled, consist of a central copper tube conductor, surrounded by an upper and a lower porcelain member which are joined in the middle by means of an iron body casting. The upper porcelain part is petticoated, and is glazed brown, so as to make it suitable for outdoor service, whilst the lower porcelain member is corrugated and is also glazed brown in order to make it suitable for immersion in oil. Oil

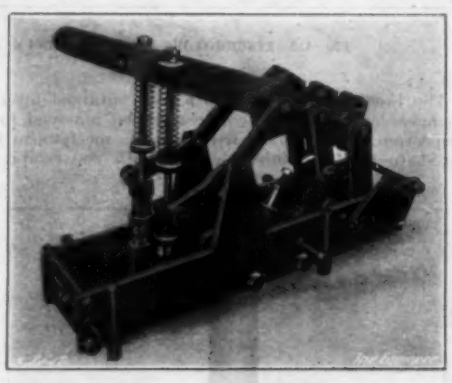


FIG. 408—LINK MECHANISM

is used for the radial insulation between the copper and the middle body casting, the path being broken up by means of concentric insulated cylinders made up of fibrous insulating material. These bushings will withstand repeated flashing over at the top end both in wet and dry weather, without causing puncture or flashing over at the lower end. By means of a patented system of internal shields an even distribution of potential is obtained over the surface of the porcelain. Oil-tight joints are made by

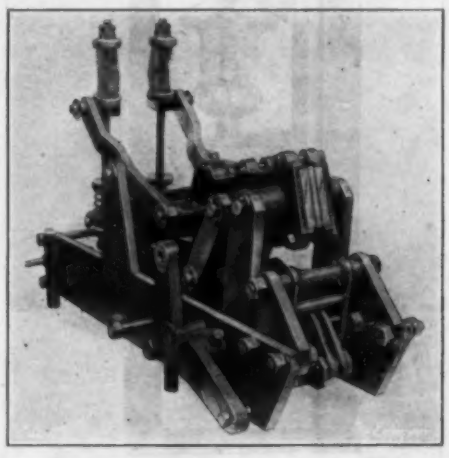


FIG 409—LINK MECHANISM

means of gaskets, arranged so that no oil is allowed to penetrate into the cement between the porcelain parts and their cast iron clamping rings. The middle body casting is arranged so that it will accommodate bushing current transformers if necessary. In designing the bushings great care was

taken to insure that the impulse spark-over value—i.e., the spark-over value when a voltage of a very steep wave front is impressed on the bushing—is as high as possible, and considerably in excess of the 50-cycle valve. This renders impulse sparking at the bushing comparatively very slow, so that lightning arresters will have plenty of time to discharge the line before the bushing has time to arc over.

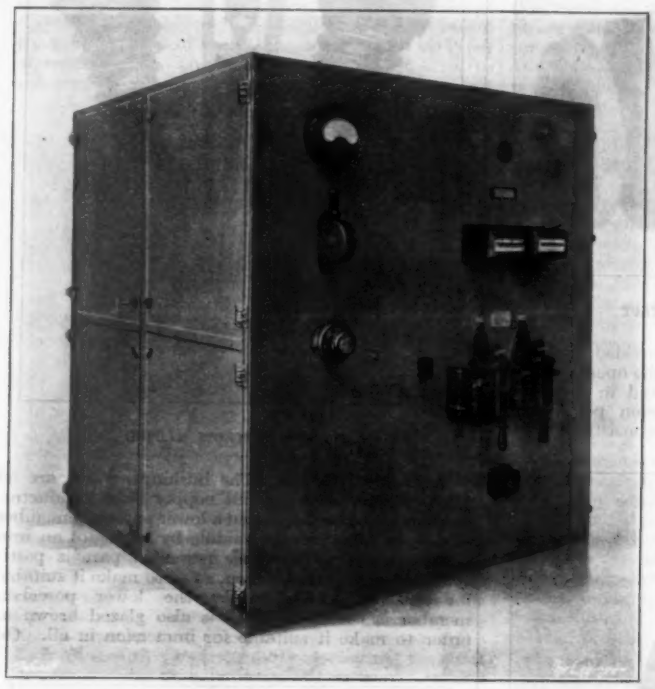


FIG. 410—SYNCHRONOUS MOTOR CUBICLE—B.T.H. CO.

The breaker mechanism is a self-contained interchangeable unit, which can readily be removed for inspection. Additional free handle mechanism is fitted to the end unit, together with the tripping

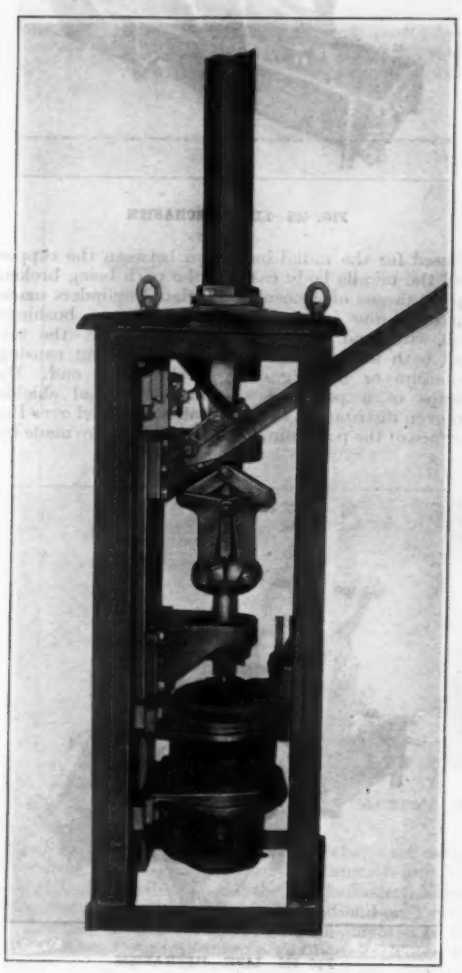


FIG. 411—OPERATING MECHANISM.

device, and a cover is provided on the trip coil casing so that it can be padlocked. A semaphore indicator indicates whether the breaker is open or closed. The operating mechanism fitted to the breaker at Wembley is of the centrifugal type, and is remarkably quick in action. The mechanism operates on the governor principle. It consists of two hinged weights—see Fig. 411—which are rotated by means of an alternating-current commutator motor. Under the action of centrifugal force these weights fly out and close the breaker through a system of levers. A tripping button and a hand-operated lever are provided for use in case of emergency. The mechanism is enclosed in a waterproof steel housing provided with a lock, and the sides of the housing can readily be removed so that access can be gained to any part of the mechanism.

Another interesting exhibit on the British Thomson-Houston Company's stand is a 275 horse-power salient pole synchronous motor, which is to be seen driving a Belliss and Morcom air compressor. For the control of this motor a switch cubicle is provided, as shown in Fig. 410. The cubicle is fitted with a four-pole double throw oil-immersed circuit breaker, an auto-transformer for starting, motor and exciter field rheostats, and a motor field switch. With this form of equipment the starting operations are extremely simple. The four-pole double throw oil-immersed circuit breaker has two handles, one for starting and the other for running, and there is also a trip mechanism which is interlocked to ensure the correct sequence of operation.

There are two interlocking bars, and one makes it impossible to close the running handle until after the starting handle has been operated, whilst the other bar ensures that before the running handle is closed the starting handle is tripped, thus avoiding the possibility of seriously overloading the auto-transformer. The four-pole double throw oil circuit breaker is also fitted with overload trips and a low voltage release. Having seen that the switch in the field circuit of the synchronous motor is open the operator then closes the starting handle of the circuit breaker, when the auto-transformer windings are connected in star across the line—as shown in the diagram, Fig. 412. This applies a reduced voltage to the stator windings on the motor which are permanently connected to tappings on the auto-transformer. When the motor attains full speed the field switch is closed, thus connecting the synchronous motor field to the exciter.

The machine then pulls into synchronism, whilst the stator leads are still connected to the auto-transformer tappings. With one hand the operator then engages the toggle of the running handle and with the other he moves the interlocking bar on the front of the panel sharply to the left. This operation trips the starting handle, thereby opening the star point of the auto-transformer, and also allows the running handle to be closed. The stator winding of the synchronous motor is now subjected to the full voltage, and the air compressor can be put on load. By adjusting the field current any required leading power can be obtained.

IN 1918 an Order, under the Light Railways Act, was made whereby the Lancashire and Yorkshire Railway was empowered to make a loop line 6 m. 40 c. long between the Liverpool–Southport line and the coast. As the time limit for the construction of the loop will shortly expire powers for an extension are being sought.

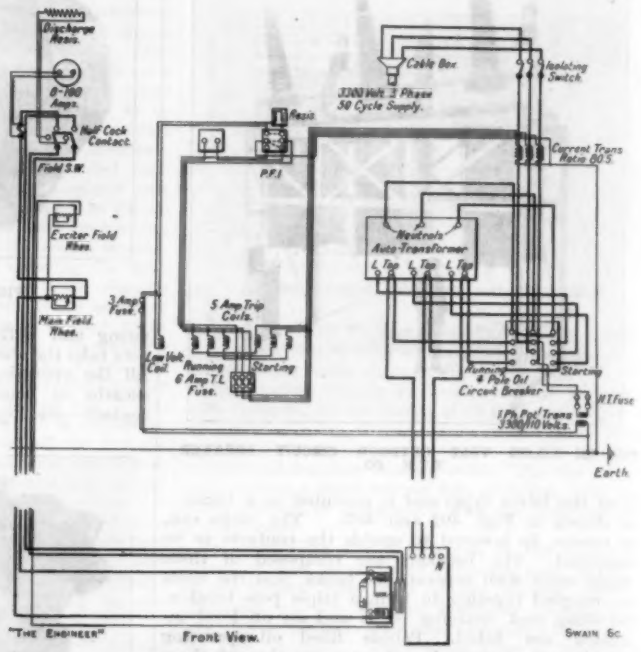


FIG. 412—CONNECTIONS FOR SYNCHRONOUS MOTOR—B.T.H. CO.

British Wire-drawing and Wire-working Machinery.

No. VIII.—WIRE FACTORIES.*

ONE of the largest factories in this country where steel wire is drawn and made up into finished products is that of Ryland Brothers, Limited, at Warrington, and the accompanying engravings give a good impression of the equipment there installed.

The total wire-drawing capacity of the works is some 1500 tons a week, about a third of which goes into the manufacture of galvanised wire netting, nails, staples, wire strand, &c., thus leaving a large surplus of plain, galvanised, tinned and coppered wire for sale in the home market and for export. The works are also noteworthy for being among the first in which the old-established practice of the Birmingham district of leaving the whole of the operations in the hands of the wire drawer was partially discarded. Many years ago additional departments which sectionalised the several processes, so that each man did not have to be highly skilled in many directions, were created in these works. Incidentally the firm was established so long ago as 1805.

Practically all the wire rods used in this establishment are purchased from the allied firm, the Pearson and Knowles Coal and Iron Co., Limited. They are pickled in the usual manner and are pointed in a special department equipped with rotary swaging machines before being sent to the wire-drawing department. The coils of rod are then sent through one or the other of several heated tunnels which provide communication between the cleaning and the drawing departments. The coils are loaded on to small trucks for their passage through the tunnel, during which they are thoroughly dried, and are pushed forward by hand. There are, of course, doors at either end of the tunnels.

On emerging from the drying tunnels the coils arrive in the drawing mill—shown in Fig. 61—where the heavier gauges of wire are produced. It is unnecessary here to describe in detail the construction of the wire-drawing blocks in this shop, as they have been dealt with in another article of this series, but it is noteworthy that they are of the type employing the cam and lever system of drawing in. There are two light overhead runways, running the length of the shop for carrying the coils of wire away through the doors seen at the end of the building. Beyond, there is a sort of hall in which the product of each man is separately accumulated during a shift and subsequently weighed, so that each man may be paid according to his output. It was very noticeable in this shop that the foreman was conspicuous by his absence. The men obviously needed very little supervision, and only required a very occasional visit from their overseer.

For drawing fine wire the wet and the dry processes are employed, according to the class of wire required. Fig. 62 shows part of the mill where fine wire is drawn in continuous machines by the three-holing process. It will be noticed that the blocks have graduated diameters to accommodate the extension of the wire as it is reduced in section. Fig. 63 shows the mill in which fine hard wire, such as

* No. VII. appeared August 29th, 1924.

THE WIRE WORKS OF RYLAND BROTHERS, LTD., WARRINGTON

(For description see opposite page)

FIG. 55 SMALL WIRE NETTING LOOMS

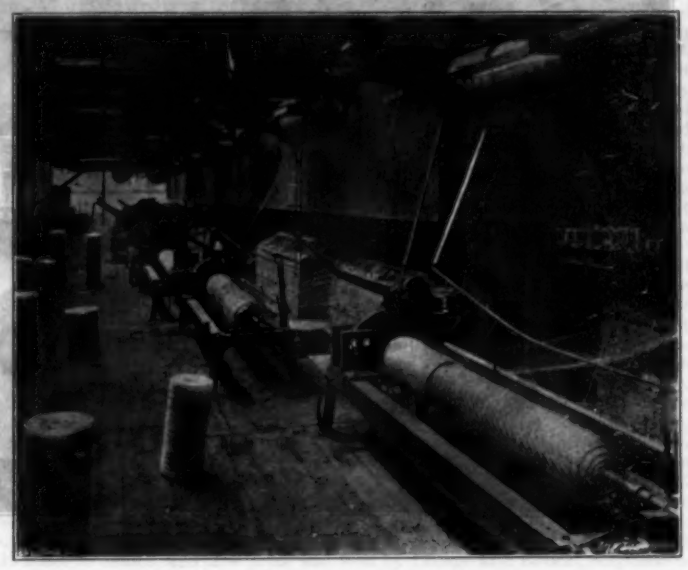


FIG. 56—GALVANISING WIRE NETTING

FIG. 57—BARBED WIRE SHOP

FIG. 58—WIRE ROPE DEPARTMENT

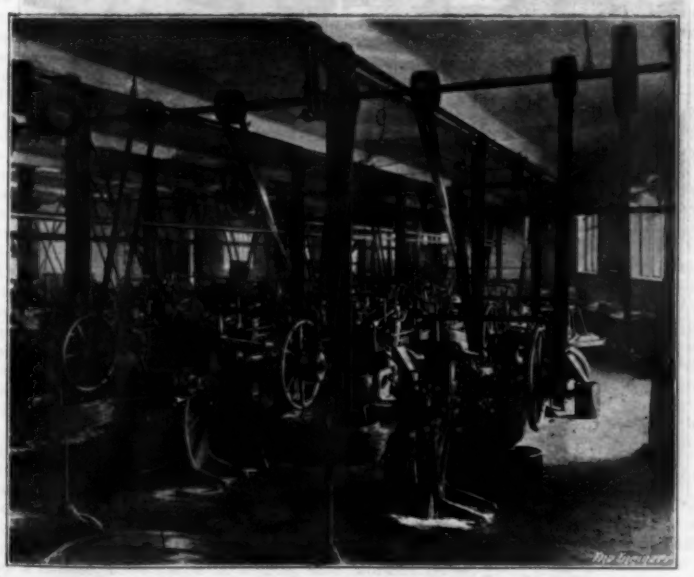


FIG. 59—NAIL MAKING SHOP

FIG. 60—WIRE FLATTENING DEPARTMENT

that used for spring mattresses, is drawn. The machines are of the continuous type, with three holes, and the coils are immersed in tubs of liquor which contain, among other ingredients, some copper sulphate, so that they are given a fresh faint coating of copper. This coating, or lacquering, greatly facilitates the drawing of the hard wire, without annealing, and merely leaves a brownish tint on the finished wire. The copper is so thin that its presence is hardly detectable by the uninitiated—so thin, in fact, that it has no material value as a protection against corrosion, but it is, nevertheless, an important factor in the successful drawing of this class of wire, and assists the subsequent tinning process to which it is subjected for the purpose of producing the finest tinned mattress wire.

In the case of the wire used in the manufacture of upholstery springs the copper coating is made much thicker, as it is required to provide a protection against rusting, and incidentally to present an attractive appearance. The wire is, however, of a much heavier gauge than that used for mattresses.

The illustration—Fig. 63—also gives a very good impression of the overhead runway system, which extends throughout the wire-drawing departments, and which is supplemented by rail trucks for heavier loads.

The foregoing notes are only intended to give a rough outline of some of the more interesting parts of the wire-drawing departments, and do not profess to cover the whole establishment, as much of the descriptive matter would be merely a repetition of what has already been said.

Among the making-up departments at Warrington, one of the most extensive is that devoted to the production of wire netting, which is made in all sizes of mesh, ½in. and to 4in. up to 9ft. wide. Figs. 64 and 55 illustrate two sections of the weaving sheds.

The machines in these shops are similar in general principle to those already described, but there are some peculiarities which mark them out as distinct.

FIG. 61—HEAVY WIRE DRAWING MILL

The machines used for making the springs for loading into the looms are well illustrated in Fig. 64, from which it will be seen that the four horizontal spindles of each machine are arranged above one another. The arrangement provides a very convenient lead for the wires coming from the traversing guide, seen in the foreground. A bundle of finished springs is shown on the horse just behind the machine, while in the background there are several of the larger netting looms.

The characteristic feature of the looms is the arrangement for drawing forward the netting as it is made; otherwise they are very similar to the machines already described. Instead of using a pegged roller for this purpose, Messrs. Rylands employ a group of three plain rolls, round each of which the netting is passed in succession. The rolling effect on the netting makes it exceptionally flat and straight, while there is no necessity for the attendant to watch for the possibility of the wires catching on the tops of the pegs.

Fig. 55 illustrates some of the smaller netting looms and gives a very good idea of the driving mechanism for reciprocating the pinion racks. The drive is transmitted through bevel wheels to a transverse shaft, with an overhung disc crank. The crank pin works in a slotted crosshead, the upper end of which can be seen on the extreme right of the driving frame. The upper and lower pinion racks are connected with the opposite ends of the crosshead, but a small amount of backlash is allowed in the connection. The extent of this backlash can be adjusted by means of set screws. There is a similar adjustment in the drive for the channel bars and by regulating the two the slight pause necessary to allow the pinions to turn can be timed correctly.

A small matter in connection with the weaving of netting, which has not previously been referred to, may be appropriately introduced here. It is, of course, impracticable to make up springs containing a sufficient length of wire to produce a roll of netting, and it consequently becomes necessary to join the wires together as the springs are exhausted.

When the end of a spring wire comes to the top pinion the attendant stops the machine and turns the spring case round so that a window at its top is accessible. He then slips a new spring into the case, through the window, and pulls out the front end of the wire, which he threads through the proper half pinion. As soon as the machine is started up again the tail end of the last wire and the beginning of the next spring are wound together round the other wire of the mesh and the subsequent galvan-

FIG. 62—MILL FOR CONTINUOUS DRAWING THROUGH THREE HOLES

FIG. 63—WET MILL FOR CONTINUOUS DRAWING OF FINE WIRE

FIG. 64—MAKING SPRINGS FOR WIRE NETTING

ising thoroughly joins together the two lengths. It is consequently possible to make a length of netting which is only limited by the rolling capacity of the machine.

After having been dipped in acid to remove scale and dirt the netting is passed through a galvanising bath—as shown in Fig. 56. It will be noticed that the spelter pots are well hooded, and it is the boast of Messrs. Rylands that their galvanising shop is one of the freest from fumes of any in the country.

The netting emerging from the bath is drawn off on to a roll which is driven through the speed cones seen in the upper part of Fig. 56. The position of the belt on these cones is so adjusted that the tension on the netting remains constant, regardless of the amount which has been coiled up, and a good hard roll is obtained. It might be interesting to record that to handle the large volume of wire and netting during the process of manufacture, this department is well equipped with electric battery trucks.

The remaining illustrations of the Ryland works represent the barbed wire, wire rope, flattened wire and nail departments, and are chiefly interesting here as examples of general arrangement, as the individual machines involved are dealt with elsewhere.

The nail shop is specially noteworthy, as it was equipped during the war, and at the special request of the Government, for making nails which previously had been imported. The machines are of the American pressure type, but some were made in England, and the organisation has been so perfected that wire nails are produced at a price comparable with that of the nails made under the more favourable conditions in vogue on the Continent. The plant is capable of producing round and oval wire nails, while there are some machines for spiral grooving wire for screw nails, and a battery of staple-making machines.

A noteworthy feature in the wire-rope making departments—see Fig. 58—is the arrangement of the machines in such a manner as to facilitate the delivery and collection of materials. The draw-off and reeling mechanism is at the same end of the machine as the feed, the rope being led round a sheave at the opposite end, so that the machine is doubled back on itself. The arrangement economises space, and also brings the feeding and take-off stations alongside one gangway.

One Hundred Years of British Railways.

No. X.*

PART II.—THE FIRST HALF-CENTURY.

THE CONSTRUCTION AND OPENING OF THE LIVERPOOL AND MANCHESTER RAILWAY.

The construction of this railway was begun in Liverpool, in what is now the Wapping goods yard of the London, Midland and Scottish Railway, near the Wapping and Queen's docks. Above the goods yard, supported on pillars, was a goods warehouse, into and out of which the wagons were raised and lowered. The railway here was 46ft. wide, and had four lines of way. A cutting, 22ft. deep, led to the Wapping tunnel, 22ft. wide, 16ft. high in the centre and 2216 yards long. This tunnel was constructed in seven sections. The first shaft was completed in September, 1826, and cut through various strata of red rock, blue shale and clay. The tunnel contained an inclined plane which carried the line to Edge Hill. This plane was 2370 yards long, in a straight line, and rose, at an average of 1 in 92 and a maximum of 1 in 48, to 123ft. above the level at Wapping. At the eastern end of the tunnel and to the north thereof was a parallel tunnel, 290 yards in length, coming from the then passenger station in Crown-street. These two tunnels cost £44,700. The shorter tunnel was on a falling gradient. The two pairs of lines joined at this point and passed under a Moorish arch designed by a Mr. Foster, who was said by Booth to have contributed greatly to the embellishment of Liverpool, but not always with so pure a taste as in this instance. The stationary engines for working the inclined plane were situated here, there being one on each side of the railway. They were non-condensing engines, supplied with steam from boilers at the mouths of Crown-street and Wapping tunnels, 448 yards distant. The engines had 25in. cylinders and a stroke of 6ft., and the drum was 21ft. diameter, making usually 22 revolutions per minute, drawing a train of 55 tons at 15 miles per hour up the incline in six minutes. Locke was in charge of the works at the Liverpool end.

Crown-street was the first passenger station to be built in this country, as the Stockton and Darlington had only calling places. It was, however, inconveniently situated, being 1¼ miles from the business centres. Authority was, therefore, obtained in 1832 to construct a station at Lime-street, and it was opened on August 15th, 1836. It was approached by a tunnel, 2000 yards in length, and worked by a rope. This method of operation continued in force until March, 1870. The *Liverpool Times* said of the station at the time of opening that it had a truly remarkable shed, with a roof that was considerably larger than that of Westminster Hall. The date 1829 is still to be seen over the western portal of Crown-street tunnel.

After 28 chains of level the line fell 1 in 1092, and included the stations at Wavertree, Broad Green, Roby and Huyton. A little beyond Wavertree was Olive Mount Cutting, nearly 2 miles in length, and cut through solid rock to a depth at places of 70ft. The spoil from this cutting was taken to make Roby embankment, 2 miles long, 15ft. to 45ft. deep, and at the base from 60ft. to 135ft. wide. At 7 miles was the foot of the Whiston inclined plane, 1 mile 47 chains long, straight and rising 1 in 96. At the top began the Rainhill level, 1 mile 7 chains long, where the locomotive tests of October 1829, were made. The line at this point was 133·76ft. above Wapping. About half a mile on the Manchester side of the top of Whiston incline the Liverpool and Manchester turnpike was carried over the railway by a bridge with a span of 54ft., on a skew of 34 deg. This bridge was spoken of in James Scott Walker's "History of the Liverpool and Manchester Rail-Way" (1830) as one of the most beautiful and remarkable skew bridges in the kingdom. It cost £3700. At 9 miles 55 chains was the top of Sutton inclined plane, falling towards Manchester on 1 in 89 for 1 mile 39 chains, the foot being at 11 miles 14 chains. The line then passed over Parr Moss. It was only 4ft. or 5ft. above the level of the Moss, and yet on the top of an embankment—filled with spoil from Sutton plane—25ft. deep.

Sankey Viaduct was built at 13 miles 55 chains, and the intervening 2 miles 41 chains had a gradient falling 1 in 2762. The Viaduct had nine arches, each of a span of 50ft., and 70ft. above the canal. It was built of brick with stone facings. Then came Newton—now known as Newton-le-Willows. Here was another viaduct—of four arches, each of 30ft. span, and 40ft. above the valley of Newton. Sankey Viaduct cost £45,200, and that at Newton £5300. At 20 miles 55 chains was Kenyon, where junctions in both the Liverpool and Manchester directions were made with the already existing Leigh and Kenyon Railway. From Sankey, for 6¾ miles, the gradient fell 1 in 894.

The next station to Kenyon was Barton, and between the two was the celebrated Chat Moss. The draining of that bog was the first work to be undertaken, a beginning on it being made in June, 1826. Chat Moss was nearly 12 miles in area, and so could not readily be avoided. Its depth varied from 10ft. to 35ft. Stephenson's scheme was to fill the space required with hurdles interwoven with bracken and moss. As they sunk, other hurdles were laid on top. Drains of the usual open type were of no effect, as they at once filled up, so Stephenson laid a primitive sort of pipe line made of empty tar barrels. At last there came signs of the road holding, but at the eastern end, where the line from the Manchester end entered on to the Moss, a solid embankment 20ft. deep below the level of the line was necessary. The work was eventually completed in December, 1829, at the surprisingly low cost of £28,000. Speaking at a public dinner in Birmingham on December 23rd, 1837, when, after the completion of the London and Birmingham Railway, a piece of plate was presented to his son Robert, George Stephenson said about Chat Moss: "After working for weeks and weeks, in filling in materials to form the road, there did not appear to be the least sign of our being able to raise the solid embankment a single inch. In short, we went on filling in without the slightest apparent effect. Even my assistants began to feel uneasy and to doubt the success of the scheme. The directors, too, spoke of it as a hopeless task, and at length they became seriously alarmed; so much so, indeed, that a board meeting was held on Chat Moss to decide whether I should proceed further. They had previously taken the opinion of other engineers, who reported unfavourably. There was no help, however, but to go on. An immense outlay had been incurred, and great loss would have been occasioned had the scheme been then abandoned, and the line taken by another route. So the directors were compelled to allow me to proceed with my plans, of the ultimate success of which I myself never for one moment doubted."

At 26 miles 17 chains the railway crossed the Duke of Bridgewater's Worsley to Manchester Canal by a stone viaduct of two arches. For 5 miles 62 chains up to this bridge the line rose 1 in 1300, and thence to Manchester, 4 miles 36 chains, at 1 in 4257. After passing through Eccles and Salford, it crossed the river Irwell and entered Manchester. Originally, the terminus should have been in Salford, near the New Bailey prison, but in 1829, by 10 Geo. IV., c. 35, powers were obtained to change the line of route, and it crossed the Irwell by a stone bridge of 63ft. span, 30ft. above the river. After passing over twenty-two brick arches and a bridge over Water-street, the terminus was reached at a point bounded by that street and Liverpool-road.

In the autumn of 1828 the question as to the power to be employed on the line was under consideration. The locomotive was not popular, and the stationary engine was seen to possess many advantages. Two directors, accompanied by Henry Booth, went to Darlington and the neighbourhood of Newcastle in October, 1828, but came back as confused as they went. One point was gained—they were satisfied that horses were out of the question. In the hope that the experts might help them, James Walker, of Limehouse, and John Urpeth Rastrick, of Stourbridge, were asked to go North, and, after seeing what had been done at Darlington and elsewhere, to report their recommendations. They went in January, 1829, and before it is said what their conclusions were, it should be remembered that the locomotives they saw on the Stockton and Darlington Railway had very limited powers, particularly when compared with stationary engines. They reported on March 9th that fixed engines cost more than locomotives to establish, but the annual charges were less. Fixed engines cost 6.40d. per ton, whilst locomotives cost 8.36d. They proceeded to observe: "But with a system of locomotives the cost of the first establishment need only be proportioned to the demands of trade, while with stationary engines an outlay of a complete establishment would be required in the first instance. But it was further to be considered that there appeared more ground for expecting improvements in the construction and working of locomotives than of stationary engines. On the whole, however, and looking especially at the computed annual charges of working the road on two systems on a large scale, they were of opinion that fixed engines were preferable, and accordingly recommended their adoption to the directors." Still the directors were not convinced, and on April 25th they offered a premium of £500 for the best locomotive. It resulted in the world-celebrated Rainhill contest of October 6th, 1829, when the prize was won by George and Robert Stephenson and Henry Booth with the Rocket.

The track was laid to the now standard gauge of 4ft. 8½in. between the inner side of the rails, but the "six-foot" was one of only 5ft. 2in. The rails first used were of T section, fish-bellied, 12ft. or 15ft. in length, and weighed 35 lb. per yard. They were laid in small cast iron chairs, secured by iron spikes driven into wooden plugs let into stone sleepers, 2ft. square and 1ft. thick. These sleepers were at first laid at right angles to the rails, but, being found difficult to pack, were placed diagonally. The ballast consisted of a mixture of broken rock and sand, 2ft. deep from the top of the sleepers. On Parr Moss and Chat Moss and on the embankments, oak or larch sleepers were laid. In all, 13 miles were laid with wooden sleepers. The rails cost £12 10s. per ton and the chairs £10 10s. per ton. The permanent way originally laid did not prove strong enough, and in 1837 powers were obtained to raise additional capital for "relaying of the road with stronger rails." These weighed 75 lb. per yard, and the stone blocks were replaced by sleepers of larch, 9in. by 4½in. and 8ft. or 9ft. long, laid 3ft. 9in. to 5ft. apart. Compressed oak keys were employed for fastening the rails in the chairs. The cost of the line was about one million pounds.

The line was officially opened on September 15th, 1830. The *Mechanics' Magazine* for September 25th, 1830, gave an account of the ceremony, from which the the following description of the return journey from Manchester is extracted: "The 24 vehicles thus left behind were now formed into one continuous line, with the three remaining engines at their head and at 20 minutes past 5 o'clock we set out on our return to Liverpool. The engines not having the power, however, to drag along the double load that had devolved upon them at a faster rate than 5 to 10 miles an hour—once or twice only, and that but for a few minutes, did it reach the rate of 12 miles an hour—it was past 8 o'clock before we reached Parkside, the scene of Mr. Huskisson's melancholy accident. Here the engines again stopped for water and a good deal of time was wasted in the operation. Proceeding onwards we were met on the Kenyon embankment by two of the missing engines which were immediately attached to the three which had drawn us from Manchester. It would be superfluous for us to inquire how it was that we happened to be deprived of the assistance of these engines since, instead of now accelerating our progress, they seemed actually to retard it. We went still slower than before, stopping continually to take water—query, to take breath—and creeping along at a snail's pace till we reached Sutton inclined plane, to get up which the greater part of the company were under the necessity of alighting and making use of their own legs. On reaching the top of the plane we once more took our seats and at 10 o'clock we found ourselves again at the company's station in Crown Street, having accomplished the distance of 33 miles in 4 hours and 40 minutes."

The passenger service was opened two days later—on September 17th, 1830—and for goods traffic on December 14th.

* No. IX. appeared August 29th, 1924.

The course into Lune Deeps of the river Wyre, at Fleetwood, is very circuitous, and the navigation of the Fleetwood-Belfast and Fleetwood-Douglas boats is very difficult as a consequence. This could be remedied by the removal of the Knott Spit—a promontory projecting 150ft. into the Wyre Channel—and this work is now being done by the London, Midland and Scottish Railway Company, the owners of the docks at Fleetwood and of the Fleetwood-Belfast steamers.

The Rugby Wireless Station.

IT is well known that a large and powerful wireless station capable of direct communication with India, Australia and other distant parts is being erected by the Post Office at Hillmorton, near Rugby. Although in his recent paper read before the Royal Society of Arts Mr. Marconi described some remarkable short wave wireless experiments, which indicate that with the beam system it is possible, at certain times, to send messages over very long distances with a very small amount of power, it does not appear that this new system is applicable under all conditions. In the discussion on the paper, Mr. Frank Gill pointed out that on some days of the year a small amount of power would not suffice for long distance transmission, whilst in reply to the discussion Mr. Marconi admitted that in his experiments the signals at night were enormously stronger than they were in the daytime, and the indications were that in the middle of the day any practical amount of power used with the beam system would not cover very long distances. He did not know, whether by narrowing the beam or by the employment of other wave lengths, it would be possible to cover great distances in the daytime. At present, he said, if there was a considerable distance of track to be traversed by the waves under sunlight, and especially if the sun was high, it was impossible to get the waves through. It would appear, Mr. Marconi explained, very difficult, if not impossible, to get messages to Australia in the daytime, although he did not know what might be achieved in the future with reflectors in use at the transmitting and receiving ends. It will be seen, therefore, that although Mr. Marconi's experiments are to be regarded as of very great importance, it is folly to suppose that the new Post Office Wireless Station at Hillmorton, and the high and costly towers associated with it, will be obsolete when the work has been completed.

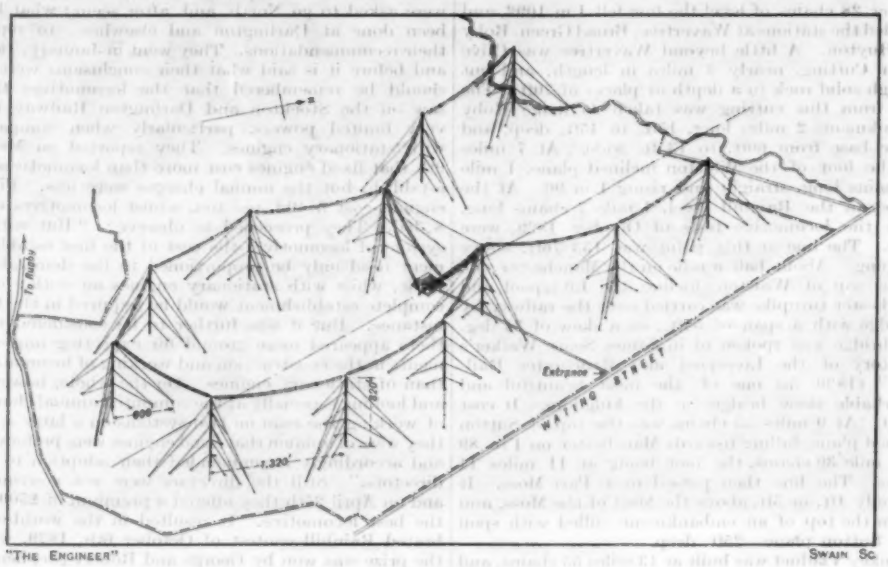


FIG. 1—ARRANGEMENT OF AERIALS

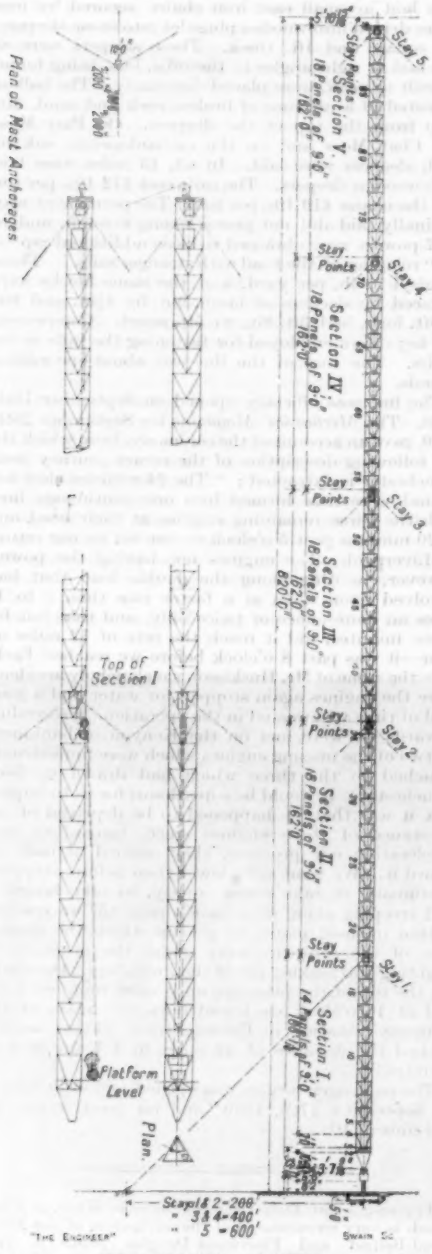


FIG. 2—DETAILS OF MASTS

A site comprising 900 acres of land has been purchased, and the station, which is to have twelve masts, arranged in two groups—as shown in Fig. 1—is being built near the centre. The masts were designed and are being constructed and erected by Head, Wrightson and Co., Limited, of Thornaby-on-Tees, to the specifications and under the supervision of the Post Office Engineering Department. Two aerials will be fed from the station in the manner shown, and it will be possible to utilise either of the aerials separately for transmission purposes. Views of a complete mast are given in Figs. 6 and 7, whilst Fig. 8 shows a mast in the course of erection. A drawing of one of the masts is given in Fig. 2, from which it will be seen that there are five stay points. The masts are 820ft. high and they are spaced 1320ft. apart. As shown in plan view—Fig. 12—the masts are of triangular section, the length of each side being 10ft. The vertical members are composed of channels and, except at stay points, where a special type of bracing has been adopted to suit the stay connections, the cross bracings are composed of K type angles. Each mast is supported on a ball-and-socket joint—as shown in Figs. 4 and 11. These joints rest on a series of twelve porcelain insulators, and the whole mast is erected on a granite block which is carried on a stanchion fixed to the foundations—as shown in Fig. 5. The insulators are inserted between cast steel entablature plates and cast iron base plates—see Fig. 10. Insulators are also used to resist any tendency for the masts to move laterally. To enable any insulator to be removed in the event of fracture portable hydraulic jacks are employed.

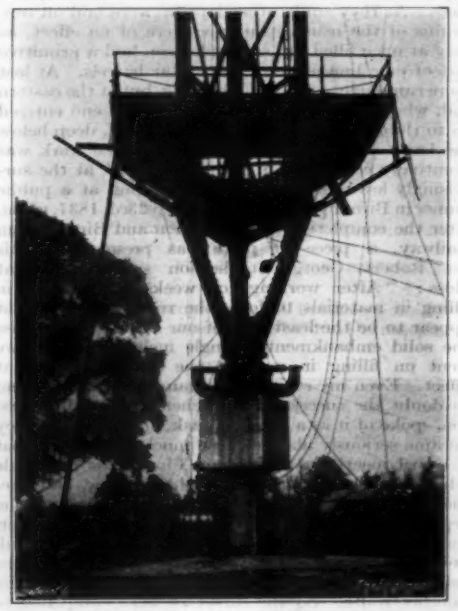


FIG. 3—LOWER PART OF MAST

FIG. 4—LOWER END OF MAST

Incidentally it may be mentioned that the task of finding an insulator that will behave satisfactorily under the influence of a high frequency field has been attended by considerable difficulties, and for that reason we believe insulators that have hitherto been employed for insulating the masts of high-power wireless stations have often been purposely short-circuited in order to put them out of action. In his address before the Wireless Section of the Institution of Electrical Engineers in 1923, the chairman, Mr. E. H. Shaughnessy, explained that when the Leafield Station was put into operation it was found that if the aerial current was increased above 190 ampères the insulators on the mast stays brushed over. When the insulators were removed for examination, they practically crumbled in the hand, and an inspection of the broken parts indicated that they had been subjected to intense heat. With arc working the aerial current is on continuously during the spacing interval as well as during the marking period, and stay insulators are consequently always subjected to dielectric stresses and they have no chance of cooling down. It seems, however, that insulators that will stand up to the dielectric stresses of a high frequency field have been procured, and no difficulties are contemplated with the mast and stay insulators that are to be used at this new high power valve station near Rugby.

FIG. 5—STANCHION FOR SUPPORTING MAST

Each mast is designed to support a horizontal pull of 10 tons due to the antenna pull at the top,

WIRELESS STATION NEAR RUGBY—H.M. POST OFFICE

(For description see opposite page.)

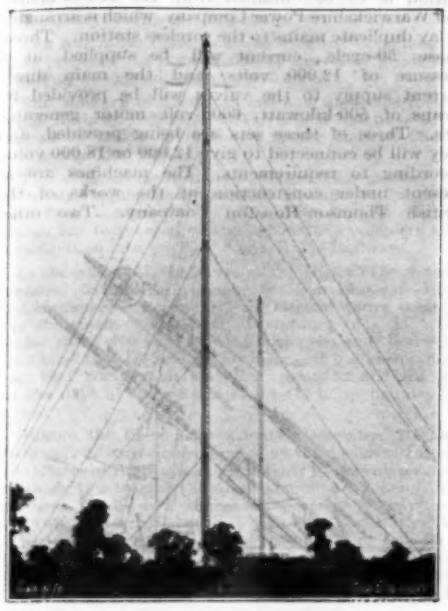


FIG. 6—820-FOOT MAST

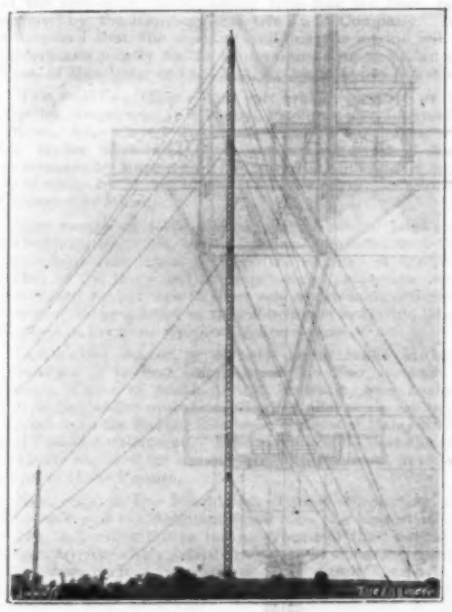


FIG. 7—COMPLETE MAST

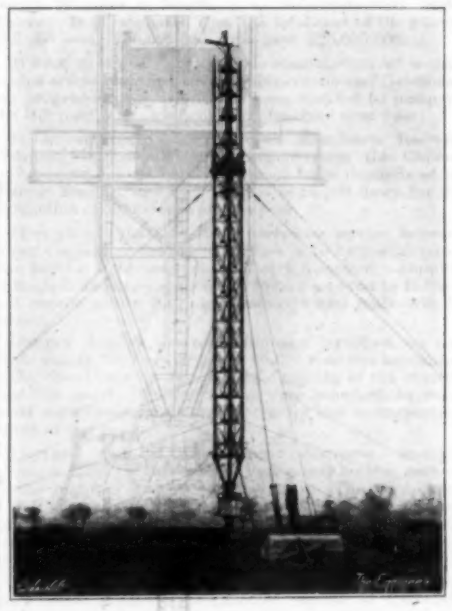


FIG. 8—MAST IN THE COURSE OF ERECTION

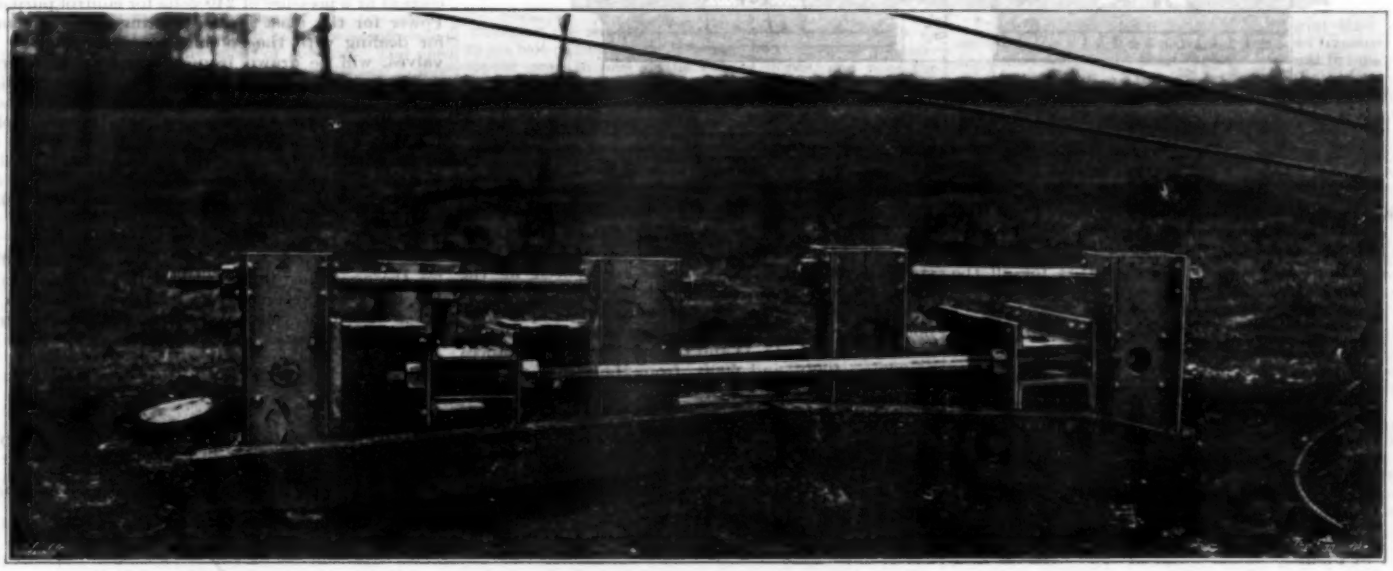


FIG. 9—STAY INSULATOR FRAME

FIG. 10—BASE PLATE FOR SUPPORTING INSULATORS

in addition to the dead weight of the mast and all the accessories. A wind pressure of 60 lb. per square foot of exposed surface has been allowed for over the entire height of the masts, the exposed

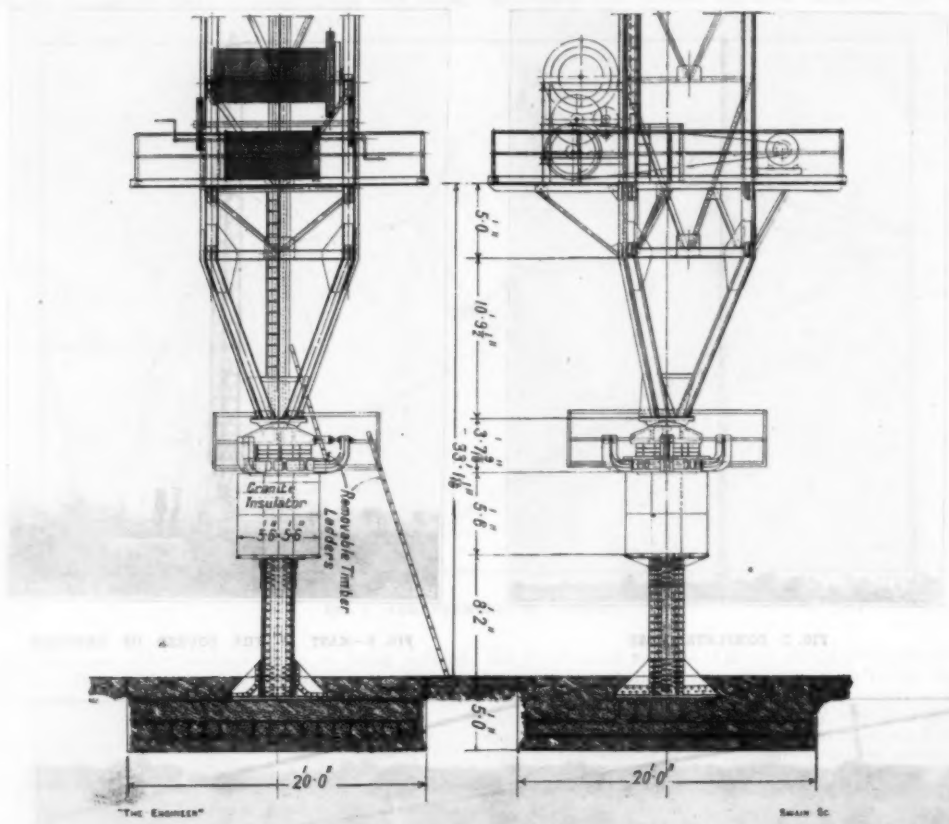


FIG. 11—DETAILS OF LOWER PART OF MAST

surface being taken as 1.6 times the area of one face. For all the steel work in tension a factor of safety of 3 has been taken and a factor of safety of 4 in all the standing wire ropes. The members for all the

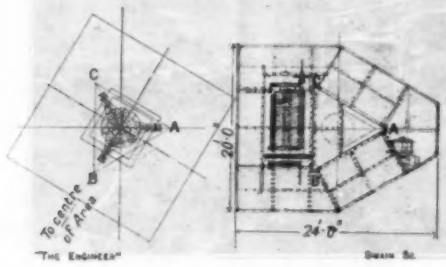


FIG. 12—PLAN OF MAST

struts are designed so that the compression stress on gross sections will not exceed the following :—

Members with l/r under 50 = 14,000 lb. per square inch.

Members with l/r 50 and over 50 = 18,000 − 80 l/r lb. per square inch.

A lift to carry three men and tools is being provided in each mast for service between the lower platform and the top of each mast, and a platform is provided

FIG. 13—ANCHOR BLOCK

at each of the five positions where the stays terminate. There is also to be a continuous steel ladder from the lower platform to the top of each mast, and a portable timber ladder from the ground floor to the lower platform.

As shown in the drawing—Fig. 11—each mast is equipped with a combined hand and power winch for hauling the antenna or lift; and the power for working each of these winches is supplied by a 20 horse-power motor. For erection purposes lifts worked by hand are being used for lifting the sections of the masts into position. The five stays belonging to each mast are spaced at the distances shown in the drawing—Fig. 2. It will be seen that the four top stays are 162ft. apart, the bottom stay being 172ft. from the base. The anchor blocks—see Figs. 13, 14 and 15—are buried at distances of 200ft., 400ft. and 600ft. from the centre of each mast. Each stay is secured separately to its anchorage, and is provided with a long tension screw for adjustment and working in a forged steel gymbal and anchor girders. Each stay is insulated at its lower end by porcelain insulators, held in frames so arranged that the insulators are in compression

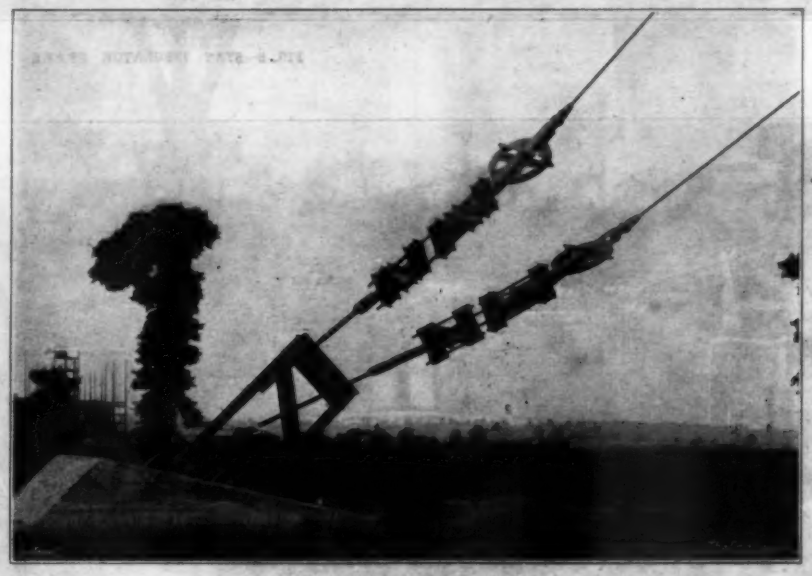


FIG. 15—ANCHOR BLOCK AND STAYS

—see Fig. 9. The initial position of the stays is adjusted by means of a hydraulic jack incorporated in one of the frames of each stay—as shown in Fig. 14—the jacks being operated with hand pumps fitted with a pressure gauge.

The aerial will consist of eight wires arranged in sausage form on spiders composed of high tensile tubular steel 12ft. in diameter, and supported by a triatic of 2¾in. steel rope, which will be carried down the centre of each mast and wound on a winch. To prevent excessive loading on the masts, slipping gear is being provided on the winch band, so that the winch will pay out when the tension on the aerial exceeds 10 tons.

The alternating-current supply for working the station is to be obtained from the Leicestershire and Warwickshire Power Company, which is arranging to lay duplicate mains to the wireless station. Three-phase 50-cycle current will be supplied at a pressure of 12,000 volts, and the main direct current supply to the valves will be provided by means of 500-kilowatt, 6000-volt motor generator sets. Three of these sets are being provided, and they will be connected to give 12,000 or 18,000 volts, according to requirements. The machines are at present under construction at the works of the British Thomson-Houston Company. Two other

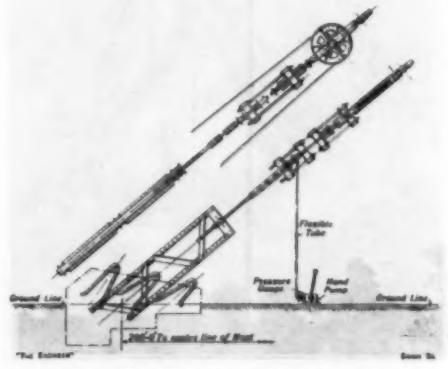


FIG. 14—METHOD OF ADJUSTING STAYS

machines built by the same firm will supply direct current at a pressure of 240 volts for control purposes. Power for the mast hoists, lighting and the pumps for dealing with the cooling water supplied to the valves, will be drawn from the alternating current mains at a pressure of 416 volts through auxiliary transformers. The valves, which will be of the metal and glass water cooled type, are being supplied by the Western Electric Company. With the aid of fifty-four of these valves 500 kilowatts of high-frequency power will be supplied to the aerial, and the circuit will be designed to give a wave length of 18,000 m.

We are greatly indebted to Mr. Shaughnessy, the Chief of the Wireless Department of the Post Office, for the assistance in the preparation of this article. We have also received very material help from his Chief Assistant, Major A. S. Angwin, and from Mr. T. Walmsley, the Post Office Engineer on the site.

Is the report of the National Physical Laboratory at Teddington for the year 1923, it is recorded that an investigation has been undertaken for the Physical Co-ordinating Research Board to determine the most suitable colour between red and green for use as a third light for railway signals. The work has been carried out to the point of specifying limits within which the hue of the light ought to fall, and experiments are now being made by the glass manufacturers to produce a suitable glass. At present this third indication, *e.g.*, for the "caution" indication in three-position signals and in distant signals on the Great Western Railway, the Great Northern and Great Central sections and on the Underground systems, is given by a yellow light. White is also accepted as a "danger" signal in shunting signals.

Railway Matters.

NINETY-FIVE passengers were killed in a collision on Friday last on the North-Western Railway of India at Montgomery, south-west of Lahore.

THE Australian Commonwealth Railway Commissioners have proposed the construction of three new goods lines, involving an expenditure of £1,170,000.

THE Ministry of Transport has now made the Ashover Light Railway Extension Order, which sanctions a very interesting traffic development in the Matlock–Chesterfield area of Derbyshire.

THE announcement made in this column on May 16th as to the inquiry into the New Zealand Railways has now been confirmed. Sir Sam Fry and Sir Vincent Raven are to proceed thither when they complete their investigation into the New South Wales Railways.

IN the year 1901, the Metropolitan District steam trains occupied 32 min. in running between Mansion House and Hammersmith; in 1911 the electric trains, stopping, like the steam-operated, at all stations, took 24, whilst to-day those that pass South Kensington and Gloucester-road take only 18½ min. This means, it has been pointed out, that the regular traveller, going to and fro once on five days of the week is saved 117 h., or five days, in a year.

DURING the three months ended December 31st last, there were 63 inquiries conducted by the Assistant Inspecting Officers of Railways into accidents to railway servants, of which 19 concerned fatal accidents to 22 men. Nine of these fatal cases concerned permanent way men, and two were signal fitters working on the line. Four of the 22 men were killed by misadventure and 17 by their own want of care. The above 63 inquiries bring the total for 1923 upto 169 inquiries, of which 50 related to the death of 56 men. Of these want of care was the cause given in 36 cases and misadventure in 10.

THE London, Midland and Scottish Company is improving its restaurant car facilities by providing an independent kitchen car. This has been done to secure greater kitchen accommodation and to secure the space formerly occupied by the kitchen for use by the public. We suggest that it will also lead to more comfortable riding, and will reduce the smell of cooking. The new kitchen cars can serve 250 meals simultaneously and supply from each end. Kitchen cars have been used on other lines but carried on six wheels. These new cars run on two four-wheeled bogies and are 50ft. long. The kitchen has a gas stove with three ovens, a hot plate with nine burners and two large hot-water boilers. The plate-warming cabinet will warm 500 plates at one time.

EARLY on Sunday morning last a collision occurred near Canfield-place on the Great Central Section of the London and North-Eastern Railway, the circumstances of which are of unusual interest inasmuch as the line at this point is not only protected by automatic signals but by automatic train control. It appears that a passenger train from Wembley to Marylebone was detained—evidently by Marylebone Station being busy with return excursion trains—at an automatic stop signal. A light engine followed and was no doubt pulled up at the two signals immediately in the rear of the standing train but allowed to proceed with caution after having come to a stand. Another passenger train followed the light engine and acted, or should have acted presumably, as the light engine had done, but it ran into the light engine and drove it forward so that it came into collision with the first train. The result of the collision was sufficiently serious to block both the main lines for four hours.

THE reason why the Dublin and South-Eastern Railway has not joined the scheme for amalgamating into one company all the railways wholly in the Irish Free State has now publicly been made known. It is stated that in 1904 the London and North-Western Railway Company lent the Dublin and South-Eastern £100,000, and made an agreement as to the division of cross-Channel traffic, which virtually put £27,000 a year in the pocket of the Irish company. The main constituent in the new group will be the Great Southern and Western, which company is a joint owner of the rival Rosslare route. The London, Midland and Scottish Company, the successor to the London and North-Western, maintains that it must retain the right to have a director on the board or be repaid the £100,000, and the Great Southern and Western maintains that the cross-Channel traffic agreement must stand. So between the two stools the Dublin and South-Eastern Railway has come to the ground and, having failed to make terms by August 31st, the conditions for its inclusion in the group must be settled by the Railway Tribunal.

A NOTE in the Journal page of our issue of February 8th last mentioned that the Inter-State Commerce Commission had made an Order requiring the 49 principal railroads in the United States, already under instructions to equip one passenger division—usually of a length of 100 miles—with automatic train control, to do so on a second passenger division. The Commission further ordered 42 railways of next importance to equip one division. The latter appealed against the Order on sundry grounds, among which was the plea that they had not been given an opportunity of showing cause why the Order should not be made. It was also urged that many of these roads had no signals and, therefore, train control could not be installed, and that the traffic was so light that even signals were unnecessary. These pleas were successful, and whilst the Order has not been withdrawn, the date by which the work was to be finished has been extended indefinitely. The bigger companies were very much less successful, as the second Order not only stands, but a further twelve months in which to complete the first has been refused. One valuable concession has, however, been made. The Commission, when issuing the first Order, deleted the recommendation jointly made by its own representatives and the companies, that there should be a permissive feature to allow a driver who was alert to anticipate, at inconvenient places, the automatic application of his brake. This recommendation has now been adopted.

Notes and Memoranda.

A 15,000 brake horse-power stationary Diesel engine of the two-cycle double-acting type has, we hear, been ordered by the Hamburg Electric Light Company. It is announced that the work of building the engine will be undertaken jointly by the shipbuilding firm of Blohm and Voss, of Hamburg, and the M.A.N. Company, of Augsburg.

THE world's gliding record was broken recently at the Alpilles Aerodrome, St. Remy, Province, by Lieutenant Thoret, who stayed in the air 9 hours 4 minutes with his motor shut off. Previous records were 3 hours 40 minutes by Maneyrol, 8 hours by the same flier, 8 hours 30 minutes by M. Barbot and 8 hours 42 minutes by the German flier Rhoen.

THE results of tests carried out on rubber latex preserved with ammonia, by the Imperial Institute, show that there is no correlation between the amount of ammonia added to the latex and the mechanical properties of the vulcanised rubber, nor is there any appreciable difference between the properties of the rubbers prepared from latices shipped in kerosene tins and in iron drums.

PORTLAND cement is already being made in large quantities in several countries of the Empire, such as Canada, Union of South Africa, Australia, New Zealand and India, whilst operations on a smaller scale are being carried on in the Sudan, Rhodesia, Federated Malay States and Straits Settlements. It seems probable that the raw products required for cement manufacture exist in nearly all parts of the Empire.

NOT only is the Shandaken Tunnel connecting the Schoharie and the Ashokan Reservoirs the longest in the world, 18.2 miles, but in boring it some of the most rapid tunnel driving with modern explosives of which any record exists has been accomplished. The tunnel is part of the recently completed system to increase the water supply of New York City. In a single calendar month, operating on a two-shift basis, 620ft. were excavated on the south heading of shaft No. 1 toward the intake end near Prattsville. This is believed to constitute a world's record for two-shift work. In another calendar month 596ft. were excavated.

COBALT ore is found in several places in the Katanga upper belt of Belgian Congo, near the soft, so-called sandy copper ores, in one of the copper mines, and near the radio-active ore mine. In all cases it is found in conjunction with manganese and in the form of a soft black mass, filling irregular spaces between dolomitic schists and dolomite, or in decomposition areas of the dolomite itself. Occasionally linnæite has been found in the solid dolomite, with beautiful erythrite in the fractures of the dolomite. The manganese cobalt ore also contains some nickel and copper. A characteristic combination from ore near the radio-active ore mine is cobalt, 6 per cent.; nickel, 1.40 per cent.; and copper, 1 per cent.

BEHIND the north end of the Burma Pavilion in the British Empire Exhibition a working unit of the Crozier retort for the extraction of crude oil from shale and coal has now been erected. This retort is the outcome of some years of investigation in connection with the development of the Burma shale deposits, and may be seen at Wembley in actual operation, extracting oil from the Burma high-grade shale. The particular advantages claimed for this retort are that a single unit can deal with 500 tons of shale a day, its low capital cost of construction, and its low operating cost. The first stage of fractionisation of oil is direct from the retort, which produces fractionated and partly refined products in one stage of operations.

THE Western Australian Government has, according to *Chemical Engineering*, decided to advance £4000 to Copper Separation, Limited, for the purpose of assisting in the erection of a plant at Ravensthorpe to treat copper ores by the metallic contact or Nevill Soanes process. This process consists in acting upon ferrous sulphate with salt, forming ferrous chloride. This acts upon the oxidised copper ore, forming cuprous chloride and cupric chloride, which is passed over iron and forms cement copper, the ferrous chloride being regenerated. The Minister for Mines said last month that if the treatment were successful it would undoubtedly revolutionise the copper industry in Western Australia. The company, it is stated, will be able to treat 30,000 tons of ore annually.

THERE will be held at Lyons, France, in the second half of October, the first Congress of the National Federation of Societies for Rural Electrification. The conference has the support of the Ministries of Agriculture, Public Works, and Interior, as well as of all of the large private organisations interested in the application of electricity to agriculture. Among other things it will consider the problems which must be overcome in order to increase the use of electricity in rural communities and will develop a movement towards the rapid consummation of the electrification programme to which the Government has given its approval. During the conference the large French electrical companies will show their products and will carry on a two weeks' demonstration of the application of electrical appliances to various phases of rural life.

THE simultaneous production of commercial sulphuric and hydrochloric acids by the action of water on a mixture of sulphur dioxide and chlorine gases is mentioned in a recent issue of the *Chemical Trade Journal*, but it is pointed out that a more satisfactory process would be the primary production of sulphuryl chloride from sulphur burner gases and chlorine in the presence of activated carbon as catalyst. The principal advantage in the production of sulphuryl chloride as an intermediate substance in the manufacture of hydrochloric acid from electrolytic chlorine lies in the fact that the chloride is a material that can easily be transported. It is a liquid boiling at 70 deg. C.; and does not attack iron at ordinary temperatures. The anhydrous material can thus be carried in iron drums to the place where the hydrochloric acid is wanted and there decomposed by means of water. This not only means a great saving in containers as compared with the transport of hydrochloric-acid solutions, but also means that no expense is incurred for carrying the water contained in these latter solutions.

Miscellanea.

ACCORDING to the *Japan Advertiser* a system of subways, nearly 50 miles in length, is to be constructed under Tokyo. It is estimated that the total cost of the scheme will be some 200,000,000 yen—say, £20,000,000.

WHILE arrangements for the construction of a new bridge across the Tyne between Newcastle and Gateshead are progressing rapidly, it has been decided to postpone the Bill for the St. Anthony's Bridge until next year.

IT is reported that the South Manchuria Railway Company has secured a concession from the Chinese Government for the exploitation of large deposits of oil shale in Fushun, and that plant is to be put down for the production of 50,000 tons of oil a year.

IT is stated that the daily aeroplane service between either Carlisle or Gretna to Belfast is to be inaugurated. One flight is to be made daily in each direction. Supplies of English daily newspapers are to be conveyed to Belfast, and on the return journey passengers and mails will be carried.

DURING August the total tonnage launched on the Clyde was 48,700 tons, of which 20,000 tons was accounted for by the Oronsay. For the eight months of the current year 148 vessels of 330,885 tons were launched, as compared with 72 ships of 148,278 tons for the corresponding period of last year.

ANOTHER German torpedo-boat destroyer, scuttled in Scapa Flow by the enemy, was raised to the surface on the night of Friday, August 29th. The equipment of 9in. wire hawsers for salvage work has been considerably increased, and another large floating dock has been acquired by the salvors, Cox and Danks, so that the work may be expedited.

CHINESE merchants in Hankow are promoting a tramway company with a preliminary capital of 2,000,000 dollars to operate a service starting at a bridge behind the Peking–Hankow Railway to Liu Kia Miao, near the Han River, a distance of 50 li. Railless trams will also be introduced. A plan has been drawn up and submitted to the Civil Governor for approval.

IT is reported from Kingston (Ontario) that plans are under way for the building there of an immense new dry dock to cost approximately £800,000 and to quadruple existing facilities. Kingston is one of the oldest cities in Canada, with a population of 22,000, and is situated at an important industrial strategic position on the river St. Lawrence, where it joins Lake Ontario.

IT is understood that the Netherlands Ministry of Marine has decided to build two new destroyers, the work to be carried out by Dutch yards. In view, however, of the lack of experience in this sort of construction of Dutch shipbuilders, the Government asked for tenders from foreign firms for designs for the new vessels, on condition that any designs chosen should be carried out in Dutch yards. The choice fell upon the designs sent in by Yarrow and Co., Ltd., which, in conjunction with the Ministry of Marine, will supervise the building.

SMALL quantities of resin are produced throughout the Oporto district of Portugal, the principal centre being the pine forest near Caminha. The industry, states the *Chemical Trades Journal and Chemical Engineer*, is not organised, and, for the most part, the resin is prepared by farmers, who tap the trees and distil the gum by the crudest methods. Although several different qualities are secured, no attempt at grading is made, and the product is classified as "Portuguese ungraded resin." About 70 per cent. of the output is consumed by local manufacturers of soap and varnish. Exportation is made in kegs containing 280 kilos. to 300 kilos.

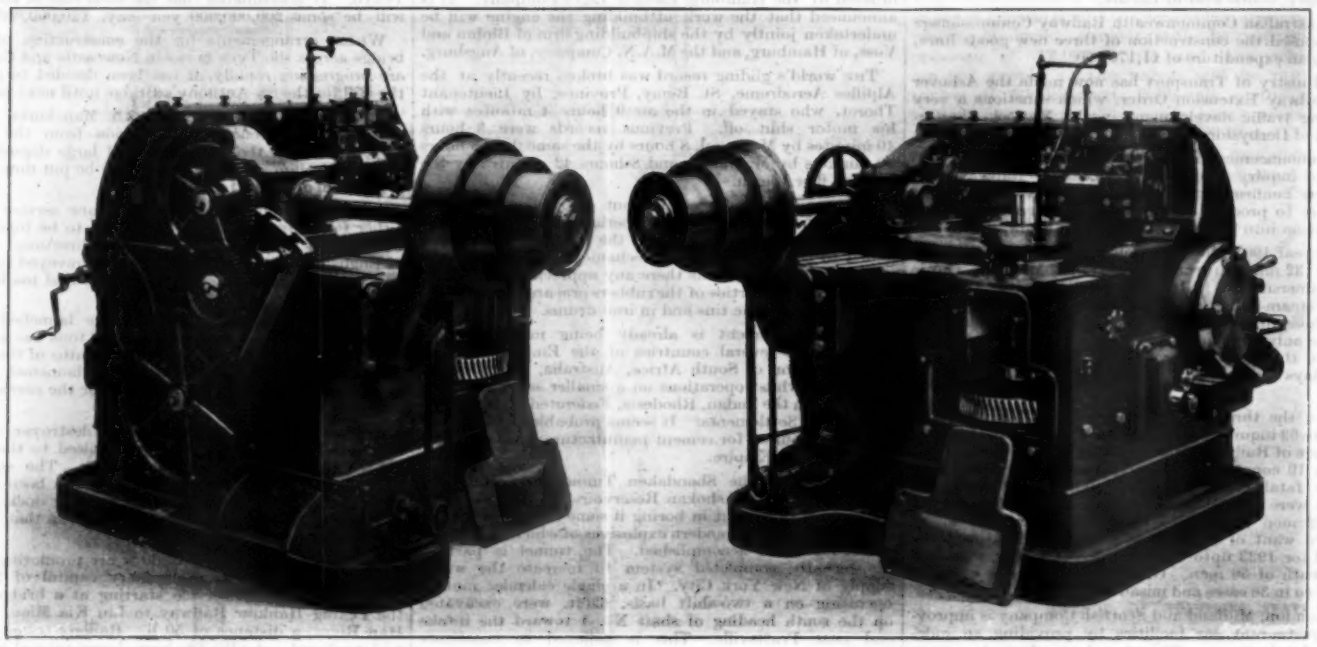
WE are informed by the Department of Scientific and Industrial Research, Old Queen-street, S.W. 1, that it is prepared to undertake in approved cases tests on plant of low temperature carbonisation. The objects of the test are to ascertain the quality and quantity of the yields of coke, tar, oil, gas and ammonia, the throughput of the plant, working temperatures, and general ease and reliability of working. No charge will be made by the department in respect of the tests, but applicants will be required to comply with certain conditions and to sign an agreement embodying the terms on which this offer is made. Forms of application may be obtained from the Secretary of the Department.

IT is reported that Lever Bros., Limited, will shortly place the contract for the construction of their new dock at Bromborough, which, with the necessary sheds and railway sidings, will cover 165 acres of the shores of Bromborough Pool in the Mersey. Of this area the dock itself will cover about 28 acres, including the entrance lock, 250ft. long and 70ft. wide. Two jetties, one on either side of the lock, will screen the entrance. The constructional work, which includes the building of 11,120ft. of heavy retaining wall and 3400ft. of dock wall, is estimated to cost about £630,000. The total cost will be nearly one million pounds. Tenders are being invited from several of the largest British contracting and engineering firms. The work will occupy about three years.

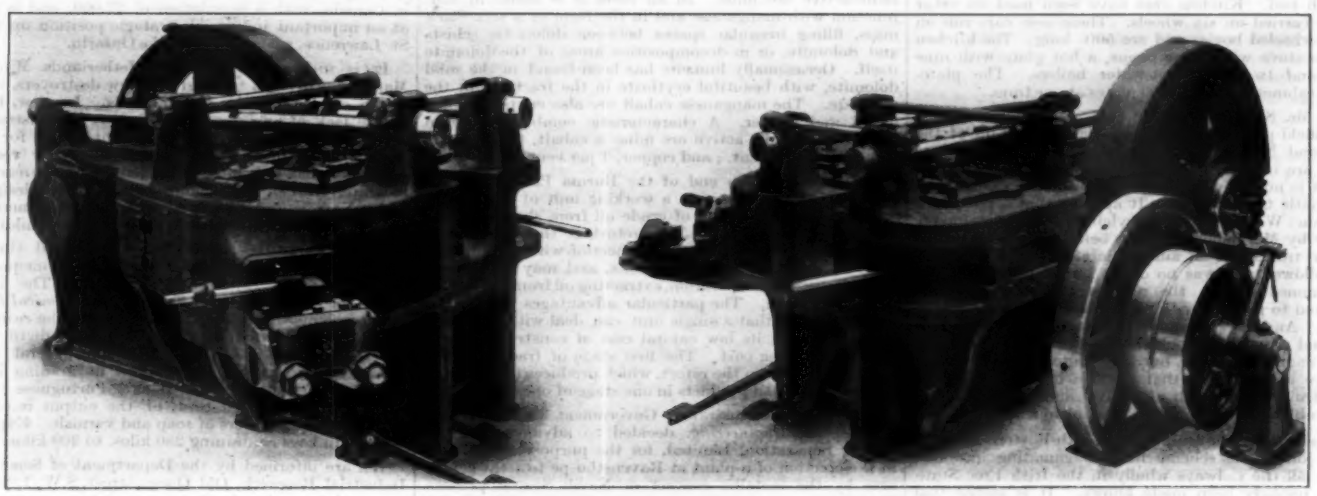
HITHERTO unattended public call boxes and kiosks have been available for telephone calls only, but experimentally such call offices within the Birmingham postal area have now been made available for the dispatch of telegrams. To send a telegram the caller asks the Exchange for "telegrams," and upon depositing the call office fee of 2d. in the coin box is connected to the Head Post Office, to which the message can be dictated. The message will be written down and repeated to the caller, and on its correctness being assured the necessary "telegram" fee (1s. or more) must be placed in the box. The new facility will permit the public to dispatch telegrams on Sundays, during lunch times, in the evenings, and on early closing days when the local branch Post Office is closed, while during ordinary business hours it should prove a convenience to suburban residents who live nearer to a kiosk call box than to a telegraph office. In the Birmingham area there are some 80 kiosks at which this new service is available.

MACHINE TOOL AND ENGINEERING EXHIBITION

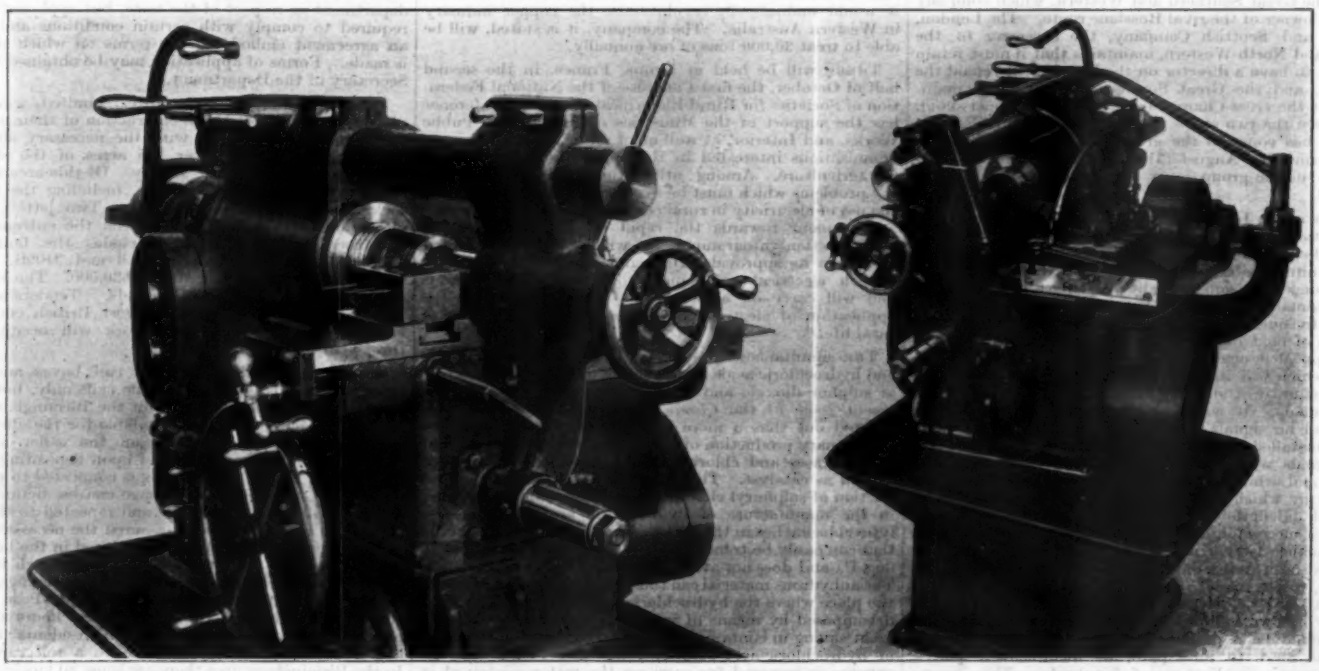
(*For description see page 270*)



FIGS. 1 AND 2—12-INCH WORM GENERATOR—SMITH AND COVENTRY



FIGS. 3 AND 4—FORGING MACHINE—THE SELSON ENGINEERING COMPANY



FIGS. 5 AND 6—NEW "SUNDSTRAND" STUB LATHE—JONES AND SHIPMAN

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Letters relating to Advertisements and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters to be addressed to the Editor of THE ENGINEER.

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THE ENGINEER.

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High Speeds at Sea.

WHEN landsmen speak of an aeroplane as having travelled at 150 miles an hour, or a railway train at 70 miles an hour, the significance of such figures is at once apparent to everybody, sailors included; but when the sailor, on his part, refers with pride to the number of knots logged by some swift ship in the course of a day's run, comparatively few landsmen are able to grasp the full meaning of the achievement. Notable speed performances at sea do not, therefore, impress the public's imagination quite so deeply as similar records established on land or in the air, where the velocity is measured in miles. True, the difference between an Admiralty knot and a statute mile—6080ft. and 5280ft. respectively—is not very great, but it becomes considerable when we are dealing with long runs or very high speeds, as the case may be. Thus, the news that the Mauretania, on her latest homeward passage, covered the 3198 miles between Ambrose lightship and Cherbourg at an average speed of 26¼ knots, means that the liner maintained throughout the voyage a speed of more than 30 miles an hour. It should not be overlooked that this wonderful voyage was made by a ship which is now in her seventeenth year. Except that her boilers have been converted for oil fuel and her turbines partly re-bladed, the Mauretania remains unaltered. Since her completion she has been almost constantly in service, and probably has a greater mileage to her credit than any other vessel afloat; yet to-day, when she is already nearing the end of that twenty-year period of "useful life" which is assigned to the average passenger liner, we find her easily surpassing the highest speed she made on her earliest voyages. We can recall no finer example of the British genius for shipbuilding and marine engineering. During the last five hours of the passage to Cherbourg her speed averaged 28½ knots, or more than 32½ miles an hour. That she could do even better, if it were worth while to force the machinery, was shown by the first run made after the re-blading of the turbines, when for a time she was moving through the water at the extraordinary rate of 35½ miles an hour. The only other vessels of large tonnage able to travel at such a speed are the British battle-cruisers Hood, Renown and Repulse; but whereas they are rarely driven at anything like full power, the Mauretania has been running for many years on a time-table designed with a view to accomplishing the swiftest Transatlantic crossing, and her machinery is, therefore, normally working at high pressure. We understand that she has averaged 25½ knots for twenty-seven consecutive voyages across the Atlantic, during which she must have encountered many varieties of weather—good, bad and indifferent. In this respect she has more than fulfilled the terms of the agreement between the Government and the Cunard Steamship Company in 1904, under which the Mauretania and her ill-starred sister Lusitania were built, and which stipulated for an average sea speed in moderate weather of not less than 24½ knots.

That the Mauretania represents the last word in high-speed ocean travel, no engineer or naval architect imagines for a moment. While it might be difficult, perhaps impossible, to improve on the lines of the hull, which were modelled with unusual care after an exhaustive series of tank experiments, turbine machinery of higher power and increased efficiency could be built to-day within the limits of weight and space available for the original plant. From the engineer's point of view it is a matter for regret that no demand should have arisen for the construction of an ocean liner to excel the Mauretania in speed. But the design of such vessels is governed by considerations other than fast steaming. High speed at sea is an expensive luxury, and unless the cost thereof can be balanced in other ways the shipowner naturally prefers to invest his capital in ships which are more remarkable for economy in fuel consumption than for swiftness of passage. For this reason practically all the ocean liners built since the war have been designed with moderate engine power. The Berengaria, though her gross tonnage is 22,000 more than that of the Mauretania, has machinery developing approximately the same power, and neither the Majestic nor the Leviathan, the two largest vessels afloat, are remarkable for very fast steaming. The former, of 56,551 tons gross, has engines of 66,000 shaft horse-power; the American ship, of 54,282 tons gross, has had her machinery modified to such an extent that her present service speed—according to *Brassey*—is only 21 knots, which is considerably lower than the original German design provided for. It was announced three years ago that the United States Shipping Board was preparing plans for two Atlantic liners of unexampled dimensions and speed. These ships were to be 1000ft. in length and to have a sea speed of 30 knots, which would enable them to make the crossing in four days. This project, however, appears to have fallen through, as everyone familiar with the economics of shipping was convinced it would. Apart from the high initial cost of such vessels, the fuel and maintenance charges would have reached a staggering figure, and it is doubtful whether a full passenger list on every voyage all the year round would have enabled them to be operated at a profit. Taking the twenty-six largest steamers now afloat, we find the mean of their speeds to be no more than 19.3 knots. Only eight are designed for more than 20 knots, and only four for speeds of 24 knots and upward. Clearly, therefore, the demand for high speeds in the mercantile marine is very limited, and it looks as if the Mauretania's possession of the blue riband of the Atlantic would remain unchallenged for years to come. It would indeed be remarkable if the completion of twenty years of service found her still the swiftest merchant ship in the world, yet that may well prove to be the case.

In the design of naval vessels economy of operation is of secondary importance, while the tactical and strategic value of high mobility is unquestioned. There has been, in consequence, a steady rise in the speed of such vessels during and since the war. The battle-cruiser Tiger, laid down in 1912, has machinery of 85,000 shaft horse-power for a speed of 28 knots. Four years later Sir E. T. d'Eyncourt planned the Hood, in which the engine power was increased to 144,000 shaft horse-power, and the legend speed to 31 knots. On the measured mile this great ship attained 32 knots—36.8 miles an hour—in spite of her displacement being 1000 tons above the normal. No other major ship of any navy has equalled this performance. The construction of battle-cruisers having been arrested by international treaty, the field of development in fast steaming is now confined to light cruisers and destroyers. As regards the former type, the swiftest vessels afloat appear to be those of the U.S. "Omaha" class, one of which, the Detroit, has traversed the measured mile at a speed of 35 knots—40.3 miles an hour—with her engines generating 97,375 shaft horse-power. No pre-war cruiser came within seven knots of this performance. The trial runs of our new light cruisers Emerald

and Enterprise will be awaited with interest; they are designed for a speed of 33 knots when in light condition, with their machinery developing 80,000 shaft horse-power. The French cruiser Lamotte-Picquet, which is to be put through her paces during the autumn, has engines of 96,000 shaft horse-power for 34 knots, but her builders confidently anticipate that 116,000 shaft horse-power and 36 knots will be realised. While nothing is known about the details of our new "County" cruisers, it will be surprising if they do not equal in engine power the swiftest vessels now building or projected abroad. The world's record for speed in the destroyer class is still held, we believe, by H.M.S. Tyrian, which Messrs. Yarrow completed nearly five years ago. On trial this vessel reached the astonishing speed of 39.72 knots, equivalent to 45¼ miles an hour. Such a velocity would have seemed incredible to the older generation of marine engineers, but it is quite likely to be surpassed by destroyers now on the stocks or about to be laid down in this country and on the Continent.

The Father of Railways.

WITH the approaching centenary the question, Who was the Father of Railways? will surely be revived. The answer is not readily found unless we limit the area of our researches. Railways, as we know them, are descended from the Stockton and Darlington, and are therefore the offspring of the wagon ways and the tramways which took coal from the pits to canals, rivers and the sea. Wagon ways, in turn, had been evolved from the wooden bars laid in mines, along which the collier pushed his tub. Of such trams and trucks we have been able to find examples in Bohemia and the Tyrol in the first half of the sixteenth century. Furthermore, our investigations suggest that Huntingdon Beaumont—one of the Beaumonts of Coleorton—adopted these means in Nottinghamshire at the end of that century, and took them to Northumberland about 1602. The wagons used by Beaumont were bigger than the miner's tub, as they were used to carry coals from the pits to the staithes on the river for shipment. Beaumont may therefore, in a sense, be considered as one entitled to be honoured as the Father of Railways in the large sense. But it is better to limit the question to the railways of to-day, with their locomotives and passenger and goods traffic. From any discussion of the early days of railways as we know them we must eliminate the proposals of those far-seeing men like William Thomas, of Denton, in February, 1800, and Dr. James Anderson, in November of the same year. These men never reached the practical stage; their schemes were but visions and dreams. The practical stage did not arrive until the Stockton and Darlington was opened, with its locomotives and passenger-carrying powers. For that reason Edward Pease has, by some, been called the "Father of Railways;" but, generally, it is to George Stephenson that the title is given. But before either men's claims can be determined there remains for decision another question. Was not the Liverpool and Manchester Railway rather than the Stockton and Darlington the forerunner of the railways of to-day? The latter was practically no more than a mineral-carrying line, of which Pease, in a letter to Stephenson after the Royal Assent had been received, said that it was to be "a great public way and to remain as long as any coal in the district remains." It was certainly not the first line to use the locomotive, which had been employed on the Hetton Railway since November 18th, 1822, and the carriage of passengers was an afterthought. The latter duty was, moreover, left to private individuals, and was not undertaken by the company itself until April 7th, 1834. The Liverpool and Manchester, on the other hand, was, from the first, designed to carry passengers as well as goods. It was the first railway on which trains composed wholly of passenger-carrying vehicles ran, and it was the first to have railway stations. It was more national than local in its characteristics. The Stockton and Darlington had for its almost sole object the carriage of coal from the Auckland district, for which many considered a canal the better means; whilst the Liverpool and Manchester Railway was designed to supplement canal navigation, to carry more quickly goods for shipment from Liverpool and cotton from that port to Manchester for distribution there, and to take the Manchester merchant to Liverpool and back in one day. If, then, it has to be admitted that the Liverpool and Manchester was the more typical of the railway of to-day, it would seem that the man who evolved that valuable work is the one to whom the title "Father of Railways" would be given without hesitation, were it not for the fact that the Stockton and Darlington preceded it by five years.

We know of no writer who does not acknowledge that the first man to develop a scheme for a railway between Liverpool and Manchester was William James. James was building railways when William Thomas and Dr. Anderson were recommending them. The line from Ticknell and Lount Wood to Ashby in Leicestershire was constructed by him and was opened in May, 1805, and in 1807 he had the Gloucester and Cheltenham line in hand. These roads were followed by the Stratford-on-Avon and Moreton-in-the-Marsh Railway, in connection with which James made and published plans for a railway thence to Oxford and London. In 1821 we find him at West Moor, seeing the experiments made with locomotives by Stephenson and Nicholas Wood. In the autumn of that year he met Edward Pease at Darlington. As we related in "One Hundred Years of British Railways" on July 22nd, there is reason to believe that the meeting took place at Pease's request and that, possibly, the report made by James as to what he had seen at West Moor prepared Pease for Stephenson's recommendation of January, 1822, that machinery should be used on the Stockton and Darlington as thereby gradients could be introduced which would give a better line. Point is added to this suggestion by the fact that Stephenson wrote to James on December 20th, 1821, that "we fully expect to get the engine introduced on to the Darlington Railway." As mentioned above, Pease was mainly concerned over the carriage of coal, and the conveyance of passengers was an afterthought. Is it not likely that James, with his wide experience of railways, suggested that Pease should get powers to carry passengers as well as to use locomotives? That James played a very prominent part in the origin of the Liverpool and Manchester Railway is shown on the high authority of Henry Booth himself. Booth was the treasurer of the Liverpool and Manchester, and in 1830 wrote "An Account of the Liverpool and Manchester Railway," in which he said that James prepared a plan for a railway between the two towns for Mr. Sandars, a leading merchant in Liverpool, and that the latter based on it a pamphlet, published in 1824, which led to the formation of a committee of Liverpool merchants to consider the proposed railway. Another writer—James Scott Walker—of that period and on the same subject, whose book was dedicated to Geroge Stephenson, observed that the Darlington road could not be said to have furnished the idea of a railway between Liverpool and Manchester. Walker proceeded to say: "Mr. James, an engineer of London, who had witnessed the operation of locomotive engines in the neighbourhood of Newcastle-upon-Tyne, had communicated his sentiments on the subject to Mr. Sandars, and the latter, impressed with the feasibility of the scheme, directed a survey to be made at his own cost." These instructions were evidently given in 1821 and the survey was made that year and the next, as there is a record of James writing to Sandars on October 4th, 1822, that he hoped that the plans would be ready for Parliament in about a week or ten days. John Francis, in "A History of the English Railway" (1851), gave more prominence to Thomas Gray than to James. He said that the application of the principle of the locomotive to public transit, the patience with which the facts were investigated and the wisdom with which they were brought to bear upon the new theory rest with Thomas Gray. Francis, however, did concede that James "was the first who absolutely surveyed the ground between these two important towns." Therein lies, we submit, the difference between the two men. Gray had the idea, but James had also the practical ability to put his ideas into concrete form. Certainly the first survey of the first railway of more than a local character was, it is seen, made by James. He was unable to do more. Although a man of affluence and of high standing in his profession he had many financial responsibilities, and his ability to carry them through was suddenly—and effectually—stopped by his arrest, inspired by family squabbles, in November, 1822, for debt. He was later made a bankrupt, and from that blow he never recovered. This unfortunate event led to a twelve months' delay with the Liverpool and Manchester scheme, but in his hour of trial James did what he could to help the cause. It is recorded in the Life of Joseph Locke that James wrote and recommended George Stephenson "as a competent person to undertake a second survey and to execute the works." It may be added that Robert Stephenson was an assistant to James in his survey in 1822. James retired later to near Bodmin, where he died from influenza on March 7th, 1837. As Herapath remarked at the time, he had the singular happiness to live to see his ideas not only realised, but realised with a success incomparably exceeding his most sanguine expectations.

In one respect certainly the Liverpool and Manchester was on a higher plane than the Stockton and Darlington. The former inspired the London and Birmingham, the Grand Junction and the other railways that, in 1846, were consolidated into the London and North-Western Railway. In our articles we are now about to trace the evolution of that great system and shall show how well merited was the term Premier Railway that was applied to it. For that it mainly was indebted to having, in its direction, many of the shrewd business men of Lancashire. Those were the men who floated the Liverpool and Manchester Railway and financed the lines, centred on Derby, which became the Midland Railway, whose progress almost equalled that of its great rival of later years. It is fitting, therefore, that we should close with one further quotation. It is drawn from a very celebrated engineer—a colleague of Joseph Locke in the construction of the Liverpool and Manchester Railway and the man who took that line across Chat Moss. We refer to Vignoles, who, in his presidential address at the Institution of Civil Engineers on January 11th, 1870, said: "It is to the courage and enterprise of the mercantile and manufacturing communities of Liverpool and Manchester that we owe their (railways) introduction, and benefits such as we have enjoyed during the last forty years." If, then, the opinion of Vignóles be shared and it is admitted that the Liverpool and Manchester was the forerunner of the railway of to-day, it would seem that to William James—its first engineer and the man who inspired Joseph Sandars—should be given the honoured title of the Father of Railways.

The British Association at Toronto.

THE British Association meeting at Toronto, held from August 7th to August 13th, was in every way a success. If any criticism might be raised with regard to Section "G" (Engineering), it would be a point dealt with in the first page of the address of the President of the Section, Dr. G. W. O. Howe, James Watt Professor of Electrical Engineering at the University of Glasgow. He pointed out that the profession is so wide and comprises so many different phases that it is difficult for one man even to follow intelligently the work of the various branches. He confined himself, having the Kelvin centenary in mind, to a rapid review of the advance of electrical knowledge in the many directions it has taken during the past hundred years. In proposing a vote of thanks to the president for this address, Professor C. Frewin Jenkin, of Oxford, showed in a most interesting way how rapid this progress had been in recent years. He related how he had been present at William Thompson's house, then only just electrically lighted, when supplementary means of illumination were available consisting of candles in beer bottles.

Although a number of subjects were dealt with in the section, and some of distinct engineering interest seemed to have overflowed into other sections, the main two matters discussed were the utilisation of the available water power of Canada, and the question of the testing of metals by subjecting them to repeated stresses or fatigue testing.

On the subject of the obtaining of power from the St. Lawrence, through the arrangements made by the Recorder of the Section, Dr. F. C. Lea, with Mr. R. S. Lea, of Montreal, members of the section were able to see the work already done on the St. Lawrence, to judge the possibilities of the future, and to travel up the river from Montreal to Toronto. This trip was rendered feasible by the courtesy of the Montreal Harbour Commissioners (of whom Dr. Hercy accompanied the party), who provided a steam launch as far as Brockville, and of the Hydro-electric Company, in whose petrol launch part of the journey up the rapids themselves was accomplished, and whose engineers, Mr. Hendry and Mr. Frail, were with the party. Mr. Mathieson, of the Government Department at Ottawa which deals with this matter, was also one of the party. Before leaving Montreal on this trip a visit was paid to the old hydro-electric station at Lachine Rapids. This station, which has been in existence since 1897, is now only a standby for the Montreal supply. It is, however, interesting from the early date at which it was built, and the visitors noted its long lengths of large shafting coupled to slow-running water turbines and driving alternators in the centre of the building. It utilises from 16ft. to 17ft. of head. The water supply of Montreal was also inspected.

On the journey to Toronto the first portion to Cedar was done by rail. Here was visited the power-

house at Cedar Rapids, where, with a 30ft. head and using eighteen machines (sixteen already running), 200,000 horse-power will shortly be available. The rotors are 27ft. in diameter and run at 56 revolutions per minute. Power is sent out at 65,000 volts to Montreal and district, and at 115,000 volts to the aluminium works at Messina, which will be mentioned later. An interesting feature in these large machines, which will on overload give over 12,000 horse-power each, is the method of suspension of the shaft which carries the turbine and the rotor of the alternator. The weight to be supported is about 240 tons, and two methods are adopted dependent upon the make of machine. In one case the familiar Michel, or Kingsbury, bearing is employed, in the other the manufacturers employ a plain steel plate bearing on one coated with white metal. This latter, composite, plate is somewhat flexible, and is supported by a large number of short strong springs. Both methods are said to give satisfactory results.

From Prescott, where the river level is practically that of Lake Ontario, to Montreal Harbour the St. Lawrence has a total fall of about 225ft., and should be able to give about 5,000,000 horse-power. The regularity of flow may be judged from the statement that if at Prescott the whole flow were stopped, Lake Ontario with all Niagara pouring into it would only rise at the rate of a little more than 1in. per day. The fall is divided into three sections. In the neighbourhood of Lachine Falls it is 45ft.; from Cotean Rapids to the foot of the Cascades in which the Cedar power station is situated, about 82ft.; and between Cornwall and Prescott 90ft. The first two of these falls are in Canadian territory and their development does not present any particular difficulty. The last section from Cornwall to Prescott extends over 50 miles and forms the boundarybetween the United States and Canada. Its utilisation has been the subject of several schemes. The international question is being dealt with here and at Niagara by a commission of three representatives of each Government, of whom General Mitchell, Dean of the Faculty of Engineering at Toronto University and Vice-President of the Engineering Section at the Toronto meeting, is one of the members.

The whole question of the St. Lawrence is, however, a somewhat intricate, although an extremely fascinating, one. The members who travelled in the motor launch from just above Cornwall to near Prescott were very impressed with the immensity of the low-pressure water available. On the journey they visited the head of the only plant of any size at present on this section. It is at Messina in the United States, where a canal about 3 miles long has been cut. By means of a submerged weir water is turned down the canal and after being used to generate power for the aluminium works at this point is discharged into the Gross River, which here is much lower than the St. Lawrence, which it joins below Cornwall.

It must not be forgotten that with all the schemes for using water for power purposes is coupled a scheme for increasing the capacity of the navigation to the Great Lakes. At present the depth is sufficient for vessels of 16ft., but in future it is proposed, to legislate for at least 30ft. draught. At Toronto Mr. R. S. Lea read a paper on the schemes proposed and referred especially to the difficulties likely to be encountered owing to ice in its various forms. Mr. Challies also provided a paper on "The Water Resources of Canada," and Mr. Mair, who, in Mr. Challies' absence, read the paper, showed a series of slides illustrating the hydro-electric plants already in operation, the number and size of which impressed his audience. A third and very comprehensive paper was one by Mr. F. A. Gaby on the "Queenston-Chippawa Development of the Hydro-electric Power Commission of Ontario."

On the following day, August 9th, the members of the Engineering Sections paid a visit to the Niagara district and saw not only the extensive works on the new Welland Canal, with its immense locks in process of construction, but the hydro-electric works. These works consist primarily of a canal about 13 miles in length leading from the intake above the falls at Chippawa to the power-house at Queenston. The first 4½ miles of the canal consist of the deepened bed of the river Welland, in which the direction of the stream has been reversed. The actual fall at Niagara itself is about 160ft., and none of the various existing power plants use more than 210ft. of the 327ft. difference of level between Lake Erie and Lake Ontario. The new power station at Queenston has a normal operating head of from 294ft. to 310ft. Arrangements have been made to place ten units of 55,000 to 60,000 horse-power each in the station. Six of these units are already installed and in service, and the party had the opportunity of seeing two others, which are all that are to be fixed at present, in process of construction. The machines, which run at 185½ revolutions per minute, naturally vary in detail from those at Cedar, which work at a much lower speed and head. The station is very compact for its large output, which is carried as far as Toronto in one direction and as Windsor in the other. Three-phase current at 25 cycles and 110,000 volts is used for transmission. Mr. Gaby stated that the Commission, which operates twenty-two hydro-electrical stations, with a projected aggregate capacity of 1,000,000 horse-power, has 3000 miles of line at 100,000 volts or over under its control.

Fatigue Testing.

The question of fatigue testing in one form or the other has been very prominently before the engineering world during the last few years. Probably this fact and the opportunity presented by a paper on the subject from the Research Professors of the University of Illinois at Urbana led to a session of the Section being given to the subject. It had been hoped that a visit might be paid to the laboratory at Urbana, but owing to the distance and time involved in making such a visit only two of the members visited the laboratories there. They were amply rewarded by seeing in progress the work Professor H. F. Moore and Professor T. M. Jasper described in their paper on "The Evidence for the Existence of an Endurance or Fatigue Limit in Metals and its Determination." These gentlemen, whose active work in this direction extends back to 1918, when the Engineering Foundation (U.S.A.) decided to finance a series of repeated stress tests, always seem to have the practical result in front of them. Their work has received financial assistance to the extent of about one hundred thousand dollars from three large manufacturing firms and from the Copper and Brass Research Association. As they truly state in the introduction of their paper, the engineer asks whether "for any given metal is there a limiting stress below which the metal will not fail no matter how often the load is repeated, and if so, what is that stress for each of the common stress-carrying metals?"

They deal with the weak points in several of the methods which have been suggested to obtain an answer to this question. Of Stromeyer's rise-of-temperature test, with which Professor C. Frewin Jenkin also dealt, they found it gave reliable results for sound wrought ferrous metal (up to a Brinell hardness of about 375). They suggest that the test really determines the beginning of appreciable slip in the crystals of the metal. This, they think, also governs Gough's running deflection test. With short-time high stress tests they have obtained results completely at variance with the results of long-time tests on the same materials. Like Dr. F. C. Lea, they have found, with wrought ferrous metals, that there is some gain of strength when metals have been re-tested at higher stress after having passed through one hundred million cycles at or near the endurance limit. An important statement is that they say that the data of long-time tests does show (and they have gone up to an American billion—1,000,000,000—cycles) that for wrought ferrous metals the assumption of an endurance limit seems normally safe. At Urbana considerable work has been, and is being, done on the behaviour of non-ferrous metals under fatigue. The tentative conclusion arrived at is that, whilst with annealed copper and annealed brass an endurance limit is indicated, for annealed bronze and Monel metal no certain endurance limit has been developed. As a conclusion they state that "It is evident that for wrought ferrous metals the elastic limit is not a very good index of fatigue strength, and that the ultimate tensile strength, the Brinell hardness, and the endurance limit by rise of temperature, are fairly reliable indicators of fatigue strength." This conclusion, in spite of the proviso "that it applies only to metals free from flaws and inclusions," is of considerable interest to designers and engineers.

Professor C. Frewin Jenkin's paper, which followed the Urbana one, was on "The Work of the Fatigue Panel of the Aeronautical Research Committee." It is a short paper, but summarises very concisely the work which had been done in various directions. Professor Jenkin points out that the problem is not yet solved, and whilst many theories have been upset, there is at present no certain guide as to where the true solution lies. He is in agreement with the previous speakers in that he believes that "there is no longer any reason to doubt the reality of a finite fatigue or endurance limit." In many other cases his conclusions are the same as those of Professors Moore and Jasper. In Professor Jenkin's laboratory Mr. Thomas has studied the effects of scratches made by diamond points and by a very finely ground steel tool, and Professor Jenkin showed lantern slides, made in an ingenious way, of sections of these scratches. The weakening effect of the sharpest of them was less than what one would have supposed, being not more than 30 per cent.

A paper by Professor Lea and Mr. H. P. Budgen deals with "The Effect of High Temperature on the Range of Repetition Stresses on Steel." It discusses certain steels which were tested at 2000 cycles per minute at temperatures varying from 15 deg. Cent. to 800 deg. Cent. Preliminary experiments showed the remarkable fact that a mild steel at 400 deg. Cent. subjected to equal tensile and compressive repetition stress had at that temperature a greater range of repetition stress for 20 million repetitions than at ordinary temperatures. The paper deals with the possible causes of this and gives the results obtained with three classes of steel. The general results have been confirmed by an experiment carried out by Professors Moore and Jasper. Professor Lea suggests that under certain conditions, which are discussed, "slip" which might lead to failure is "healed." The subject is one of very great importance, having in mind the high temperature which metals used by engineers are being subjected to with the constantly increasing temperature at which steam is being used, and it is to be hoped that the experiments which he and his colleagues are still carrying out may lead to further light being thrown on the subject.

The fourth paper of the series was by Mr. C. E. Stromeyer on "Torsion Fatigue Hysteresis," but, in the absence of its author, it was taken as read.

Little new arose in the discussion on these papers, but it was pointed out that in many of the pieces of machinery used in ordinary engineering practice the stresses were not regular and constant, but that parts generally were subjected at irregular intervals to shocks and higher stresses. An important point mentioned by Professors Moore and Jasper was also raised, viz., that the materials experimented on are those free from flaws and inclusions.

The subject of fatigue testing was also dealt with in several of the papers submitted by the Complex Stress Committee, and the last few words of Professor Jenkin's paper that someone would "speak the word that will set all these diverse phenomena in orderly array" were decidedly to the point. It is very desirable that in these days of increased speeds, as well as increased temperature, the experimental work which is being carried out should continue, and it is to be hoped that it may be kept in close touch with the practical occurrences of every day.

Transportation.

One morning was devoted to transportation, but it was regretted that Sir Henry Thornton, whose work on the Canadian National Railroad is being followed with so much interest, was unable to present his paper on "Railway Transportation in Canada" in person. Lieut.-Colonel H. S. Lamb dealt with "The Engineering Problems and Traffic on the Great Lakes."

Various Subjects.

Other papers read dealt with very varied subjects. It was a pity that the joint discussion on "Liquid and Powdered Fuel" took place between the Chemistry and Geology Sections, and that the times clashed with the session devoted to fatigue testing in the Engineering Section. This was all the more to be regretted as the first paper, which was not mentioned in the *Journal* and had evidently been inserted at a late hour, was on "The Application of Powdered Fuel to Steam Raising," by Colonel Sauvage. It occupied a considerable time in presentation and might advantageously have been shortened by curtailing the information to the use of powdered fuel on locomotives, which does not seem to have made much progress. The slides shown were on too small a scale for so large a hall, but did impress the audience with the extent to which this method of firing is now applied to steam raising in electric power plants in the United States. It was unfortunate that the Engineering Section could not have arranged an excursion to the station at Cleveland, where a large plant has recently been installed, in which the height from the ash doors to the top boiler tube is about 52ft. and the volume of the combustion chamber about 29,000 cubic feet, or enough space for a six-roomed house. This station and the new one in connection with the Detroit-Edison Company at Trenton Channel were visited by individual members of the Association.

In addition to the visits referred to, the harbour and filter beds at Toronto were visited, as were the numerous and interesting laboratories of the University and of the Ontario Hydro-electric Commission.

It will be appreciated that the meeting and the excursions were full of interest from an engineering standpoint. After the meeting a large party of the members took part in an excursion across the continent to the Pacific.

BOOKS RECEIVED.

Sydney Harbour Bridge: Report on Tenders. By Dr. J. J. C. Bradfield, Chief Engineer for the Bridge.

The Mineral Industries of Canada. British Empire Exhibition Edition, 1924. Canada: Mines Branch of the Department of Mines, Ottawa.

Carburation in Theory and Practice. By R. W. A. Brewer. London: Crosby Lockwood and Son, Stationers' Hall-court, E.C. 4. Price 15s. net.

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Machine Tool and Engineering Exhibition at Olympia.

No. I.

THE third Machine Tool and Engineering Exhibition organised by the Machine Tool Trades' Association was opened to-day—Friday—by Lord Askwith, at 3 p.m. The first Exhibition conducted by the Association—or rather by the Machine Tool and Engineering Association, as it was then designated—was held in October, 1912, and the second in September, 1920. Both these previous Exhibitions took place in the midst of "boom" periods of trade and were remarkably successful. An early tour of the present Exhibition and a considerable preliminary study of the machines shown at it lead us to the opinion that it, too, will prove a success to all concerned, in spite of the admitted difficulties of the times, the existence of trade depression, and the counter-attractions of the Exhibition at Wembley.

Whether or not the Council of the Machine Tool Trades' Association acted in the members' best interests when it decided not to permit them to show their products at the British Empire Exhibition is a matter upon which we believe there has been considerable discussion. It would certainly appear that many visitors to Wembley have been more than disappointed at the all but complete absence of machine tools from the Palace of Engineering. On the other hand, it is undoubtedly true that a short period exhibition, appealing primarily, if not solely, to engineers and other possible buyers of machine tools, is likely to yield a much better business return than one spread over six months and attracting visitors of whom less than one in a hundred will ever purchase or influence the purchase of any machine exhibited. Moreover, a Machine Tool Exhibition without the machines at work would be deprived of much of its interest and commercial value. On this score it was held, we understand, that the cost of power and material for a six months' Exhibition would prove prohibitive to many of the members.

The Exhibition contains many objects which are of general engineering interest, although in this respect it is, we believe, less well supported than either of its forerunners. Among the machine tools, the staple exhibits, we find, as in former years, a considerable proportion of American and other foreign tools, with the exception of German, which, as in 1920, have been excluded. The British machine tool industry is well represented, hardly a single important manufacturer having failed to partake in the Exhibition or to secure representation at it. As for the machines themselves, their number is great, greater perhaps than in general is their novelty.

We begin below an account of some of the principal exhibits. With next week's issue, in addition to continuing our account, we shall publish a special sixteen-page Supplement describing a selection of the machine tools of British origin which are being shown.

SMITH AND COVENTRY, LIMITED.

Turning and Boring Mill.—The machines shown by Smith and Coventry, Limited, Manchester, include a 4ft. vertical turning and boring mill fitted with a twelve-speed gear-box and direct drive by a constant-speed motor; a 12in. worm gear generator; a patented spiral bevel gear planer; a duplex keyseating and morticing or slot drilling machine capable of cutting cotterways up to ¾in. wide by 6in. long through a thickness of 3in; and two sensitive drilling machines, with four spindles and ball bearings. All these tools are shown in motion and form a very attractive exhibit. The 4ft. vertical turning and boring machine, illustrated in Fig. 7, represents this firm's latest design. The table has parallel T slots to receive chuck jaws and additional T slots for securing the work. It is mounted upon a long vertical spindle running in a cylindrical bearing provided with adjustment for wear and supported on a broad annular surface on the bed, which is submerged in oil. The large machine-cut gear ring which operates the table is driven by a forged steel pinion, which in turn is driven either by a twelve-speed gear-box with a single pulley drive or by a six-speed gear-box and variable-speed motor, or by a twelve-speed gear-box and direct drive by a constant-speed motor.

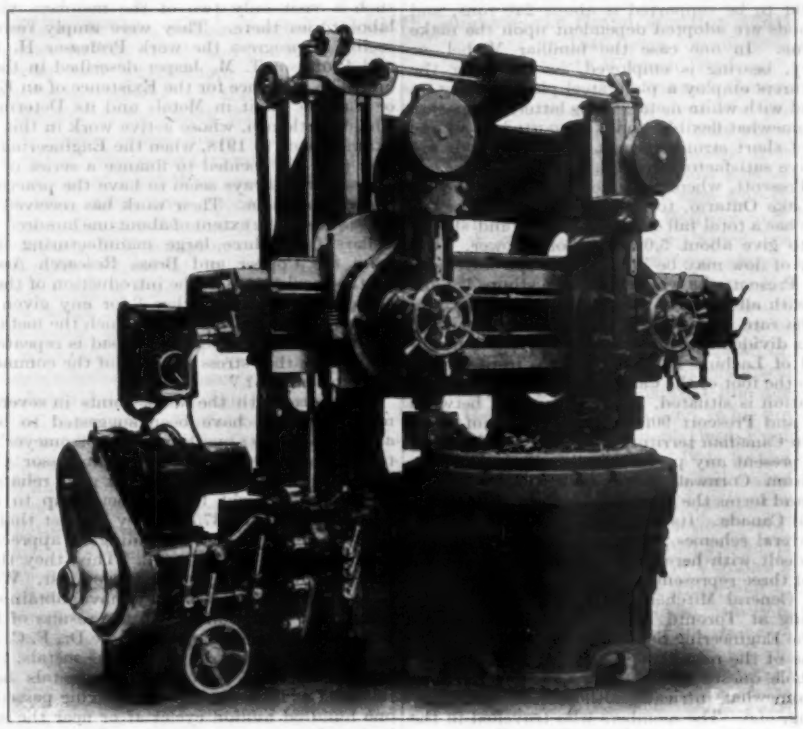


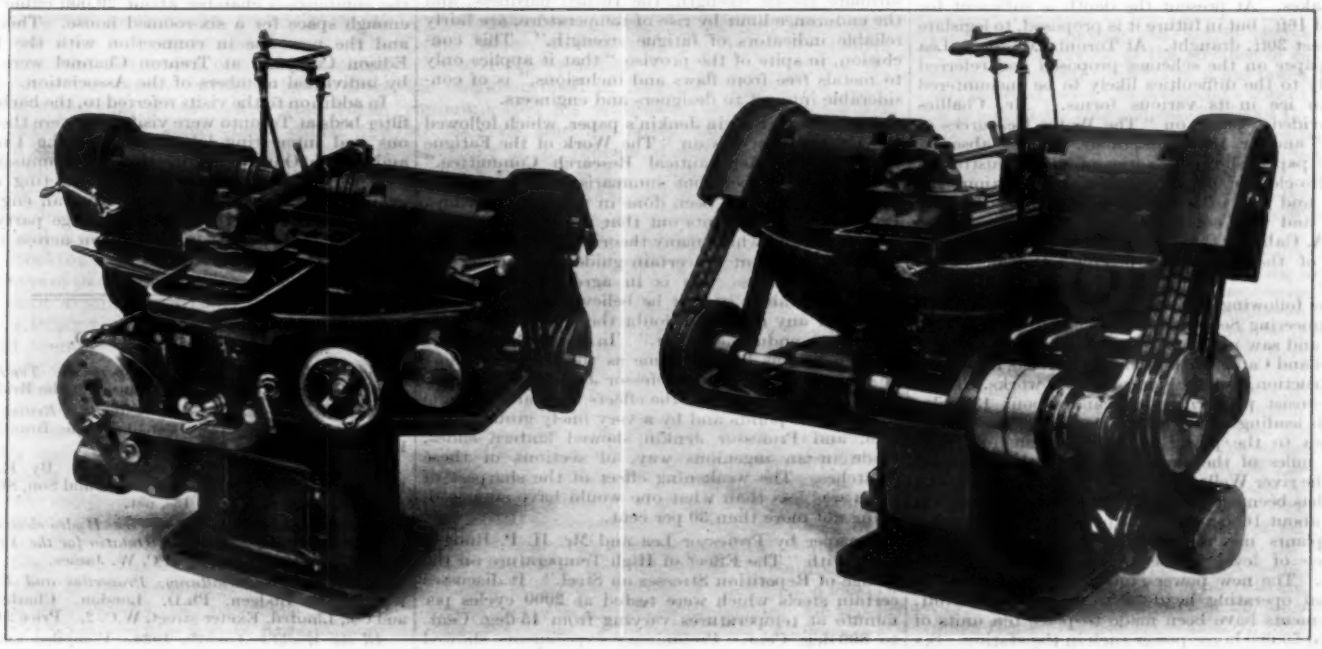
FIG. 7—BORING AND TURNING MILL—SMITH AND COVENTRY

The uprights of the machine are of deep box form and the cross slide upon which the tool slides are moved by screws and a narrow guide is also of box formation. The tool bars are of octagonal form and are made of forged steel, being balanced by a self-contained spring device on the saddle, the traversing racks being cut in the bars. The tool bars can be swivelled through an angle of 30 deg. in either direction for angular turning and have a wide range of feeds from $^1/_{32}$in. to ⅜in. per revolution of the table in both directions. The changes of feed are brought about by an improved feed gear-box in which the multiplying of speeds for the faster feeds is largely avoided. A quick-power traverse up to 48in. per minute is fitted to the machine. The feed mechanism to each tool bar is independent and provision is made whereby change gears can be used for cutting regular threads. All driving pinions are of forged steel and many of the other gear wheels are either steel castings or have forged steel rims shrunk on cast iron centres. All the heavily loaded bearings are lined with gun-metal and are well lubricated.

The following are the chief dimensions of this tool:

Height under tool holders	30in.
Table diameter	44in.
Table speeds	Six
Speed range	2 to 1
Size of motor, horse-power	10
Size of tool bars, octagonal	3in.
Traverse of bars, octagonal	18

Worm Gear Generator.—The worm gear generator illustrated in Figs. 1 and 2, page 266 is of the tangent feed pattern and is fitted with Smith and Coventry's lever generating mechanism. The special qualities which the makers claim for this type of machine are:—(1) The extreme directness of mechanical connection from the hob or fly cutter to the master worm which revolves the blank, permitting heavy cuts without relative displacement due to torsion of intermediate shafts; (2) the mechanism by which the revolving generating movement is obtained can be manipulated in any way without disturbing the relative positions of the wheel blank and hob; and (3) the change gears



FIGS. 8 AND 9—DUPLEX KEY-SEATING AND SLOT-DRILLING MACHINE—SMITH AND COVENTRY

are easy to calculate, as they obviate small fractions. The machine has twenty rates of tangential feed, giving a range of about 150 to 1 to cover all practical combinations of number of teeth and number of starts. Automatic trips are provided in each direction and the feeds are changed by levers moving over graduated dials. The index worm is hardened and accurately ground and the index worm wheel is divided for purposes of correction and adjustment. The working centres can be set by direct measurement and provision is also made for using gauge rods for the centres and pitch diameter of the worm. The generating mechanism is an example of a practical application of simple geometrical principles, by which the wheel blank receives an added movement corresponding at

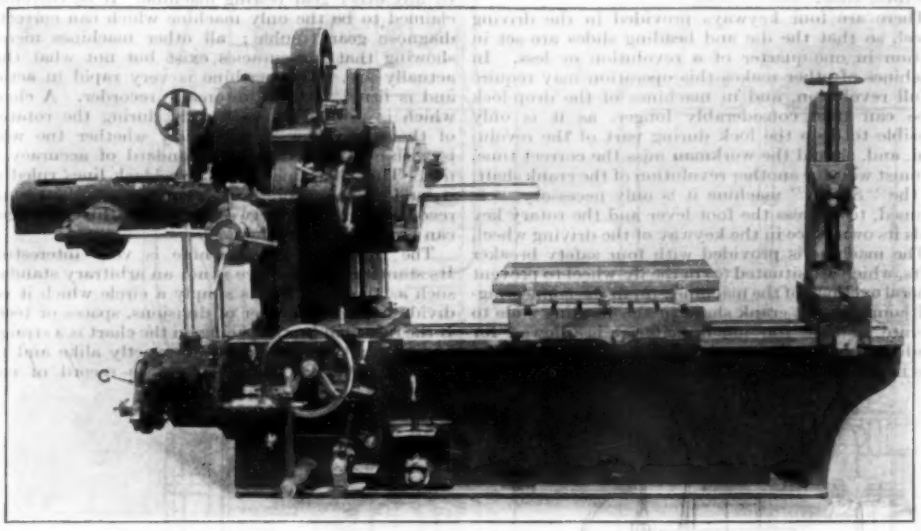


FIG. 10—UNIVERSAL SURFACING, BORING AND MILLING MACHINE—KEARNS

the pitch line with the tangential traverse of the hob or fly cutter without the use of change gears. The tangential feed can be started, stopped, and changed or reversed while the machine is in motion. This is an advantage, since the best conditions of operation are often only known after cutting has begun. These machines are operated by a countershaft and a three-step cone pulley running in ball bearings. They are made in three sizes with 12in., 20in., and 30in. maximum working centres. The largest circular pitch which the 12in. machine will cut is 2in.

Keyseating Machine.—The duplex keyseating and slot drilling machine illustrated in Figs. 8 and 9 embodies recent improvements in design. It will be observed that the machine is driven by means of a single belt from the rear and a fast and loose pulley on a shaft from which motion is transmitted by link belting to the cutter heads. The driving belt can lead off at any reasonable angle and obviates the employment of the numerous vertical belts previously necessary, which obstructed the operator's view of the work. The machine has a capacity for dealing with slots or cotter holes up to ¾in. wide by 6in. long through shafts 3in. diameter. The clamp for holding the work is of compact design, allowing the jobs to be gripped very near to the keyway or cutter hole which is being produced and the clamp is short to pass between the cutter heads. The work table is caused to reciprocate by means of an adjustable crank disc arranged in the vertical plane instead of horizontally, as in previous machines. The spindle heads, too, are of new design, the spindles with their ball bearings being mounted in sliding sleeves which are moved by face cams in the headstocks. The cams are operated in unison by spur gears and spirals for cutting similar keyways on both sides of a tap, for instance; but for through slots or cotter holes one cutter is arranged so that it reaches the centre of the shaft in advance of the other cutter and then recedes quickly when the second cutter advances to remove the remaining thin web of metal. To accommodate cutters of varying lengths and different diameters of work the spindles upon which the face cams revolve are long and the cams can move longitudinally and rotate in any position.

The method of setting and cutting a keyway is as follows:—A suitable cutter is put into the collet chuck of each spindle. The work is then placed in the clamp and tailstock and the adjustable crank is set to the required traverse which equals the total length of the keyway less the diameter of the cutter. After starting the machine the table can be adjusted to the keyway position and a hand wheel is then revolved until the depth of the keyway desired is read on a dial. Another clamp is then released and the handle is operated to bring the cutter into contact with the work. Means are provided for setting the depth of feed desired and the machine is started. Cutting proceeds automatically to the correct depth and then the spindle recedes quickly. For cutting slots and cotter holes a similar method is adopted, except that the dial is set to read half the diameter of the job and a knob is set to advance the left-hand spindle so that it finishes its cut the first.

Messrs. Smith and Coventry also exhibit their well-known spiral bevel gear planer and patent ball bearing four-spindle sensitive drilling machines.

H. W. KEARNS AND CO., LIMITED.

Universal Machine.—Three examples of their universal surfacing, boring, milling, drilling and tapping machines are being shown by H. W. Kearns and Co., Limited, of Broadheath, near Manchester. In Fig. 10 we illustrate the intermediate size of this type of machine as it is now constructed. This class of machine is already familiar to our readers, for Messrs. Kearns have made it a field for specialisation for many years. The examples exhibited, however, embody some new features. The machines are equipped with automatic facing chucks and with independent travelling spindles rotating at a high speed separately from the chuck. In the case of the

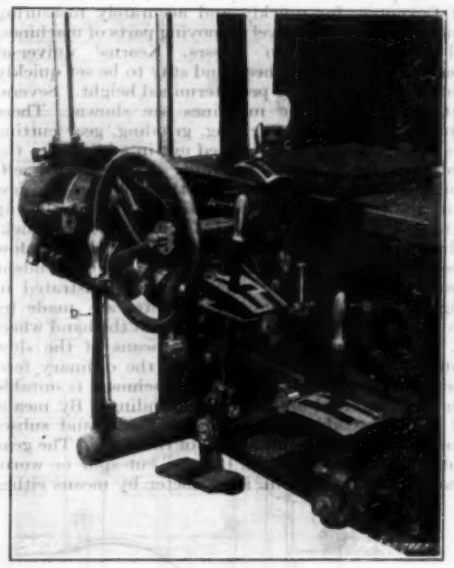
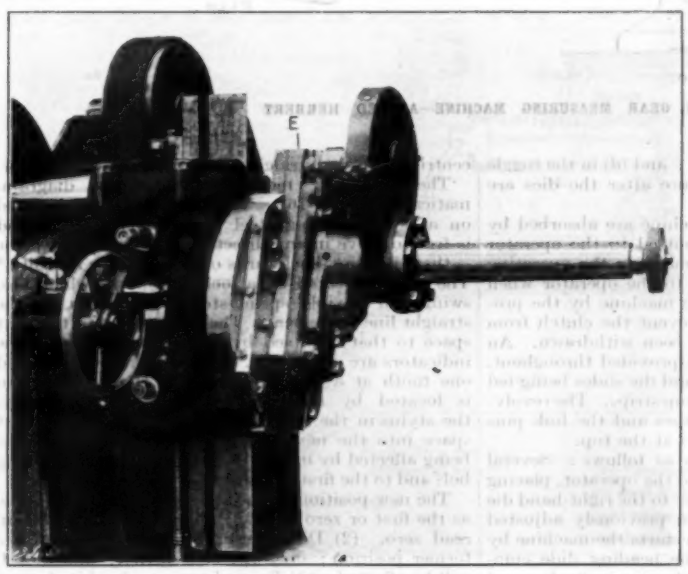
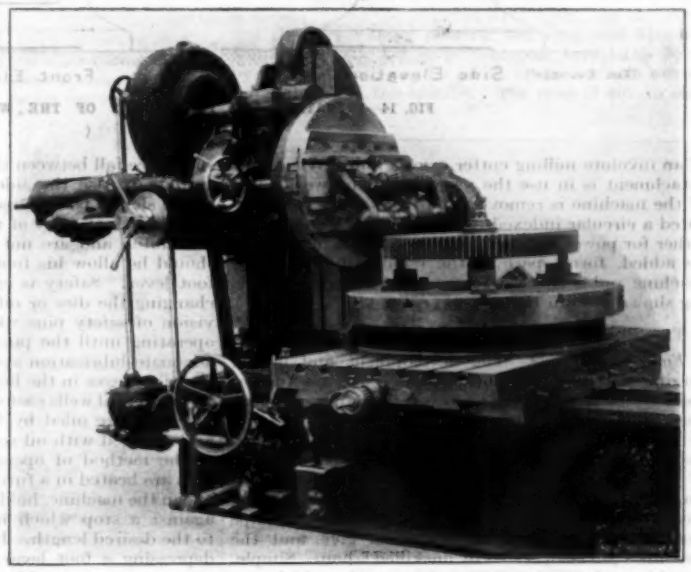


FIG. 13—UNIVERSAL CONTROL GEAR—KEARNS

machine illustrated the independent spindle has a diameter of 3in. The maximum facing capacity is 30in. Driving power is supplied by a constant-speed direct-current motor of 5 horse-power running at 750 revolutions per minute. Messrs. Kearns have designed the machines to be as fully universal as possible and, with the assistance of certain attachments, to enable occasional work, such as grinding or gear cutting, to be done by a firm whose needs in such directions are not sufficiently frequent to justify the installation of a special and expensive tool for each purpose separately. At the same time it has been sought to preserve the efficiency of the machine for mass production work, and that this object has been achieved seems to be borne out by the fact that in this country and elsewhere many are at work as single-purpose machines. In a machine capable of carrying out so many different duties the number of motions, feeds and speeds required would, it might be thought, give rise to some complexity in its working and management. This point has been well attended to, with the result that ease and safety of manipulation have, it is claimed, been secured, largely, it may be added, by the adoption of the gate-change principle familiar in motor car practice. In Fig. 13 we reproduce a photograph illustrating this point. The lever A operates the main feed and rapid power motions and is automatically self-locking to each, so that when the feed motion or rapid power motion is in engagement the other cannot be brought into use. The lever B, also of the gate-change type, controls the speed change. The lever C operates the





FIGS. 11 AND 12—GRINDING AND GEAR-CUTTING ATTACHMENTS FOR UNIVERSAL MACHINE—KEARNS

vertical, longitudinal and transverse motions both with respect to the feed and the rapid power movement. The main starting lever is shown at D. As compared with earlier designs, the two levers A and C take the place of five levers formerly employed, so that the complete power control of the machine when at work is effected by means of four instead of seven handles. The machines as exhibited are fitted with metroscopes on the spindle slide and the boring stay. The metroscope, as our readers may recall, is a simple device made by Alfred Herbert, Limited, of Coventry, for quickly and accurately measuring and indicating the travel of moving parts of machines. Their application to Messrs. Kearns' universal machines enables the head and stay to be set quickly and accurately to any predetermined height. Several attachments for the machines are shown. These fittings permit flange drilling, grinding, gear cutting and taper boring to be carried out in addition to the ordinary duties of the machine. They are all self-contained and can be fitted to the machine in a few minutes' time. With the exception of the taper boring attachment they are mounted on the facing chuck, which is either held stationary or revolved at a slow speed and are driven by the fast-running independent spindle. The grinding attachment is illustrated in Fig. 11. Adjustments for diameter are made by moving the facing slide E by means of the hand wheel F. The feeds are obtained by means of the slow rotation of the facing chuck and the ordinary feed motion of the work table. This attachment is suitable for both internal and external grinding. By means of it it is possible to bore out a cylinder and subsequently grind it at one setting of the work. The gear cutting attachment—Fig. 12—can cut spur or worm gear wheels up to 60in. in diameter by means either of an involute milling cutter or of a hob. When this attachment is in use the usual revolving work table of the machine is removed and in its place is substituted a circular indexed table which can be arranged either for power or hand feed. Screw cutting, it may be added, forms part of the regular duties of the machine and is effected by means of the change gearing shown at G in Fig. 10.

THE SELSON ENGINEERING COMPANY, LIMITED.

Forging Machine.—The development and use of forging machines in Europe date back no further than the beginning of the present century. Before that time they were practically unknown on this side of the Atlantic, but during the intervening years manufacturers have come to realise the great value of this type of machine for the mass production of forgings from the bar. The work produced is much cleaner in finish and more exact to size and shape than ordinary forging methods can give, and the machines can be operated by unskilled labour. Simple, durable and comparatively cheap tools, which can be quickly and easily exchanged, alone are required. These advantages tend to cheapen production and the saving effected when parts have to be made in quantities is said to be so great that many articles previously made of malleable iron or steel castings can now be economically produced in the form of a forging. Tests have shown, it is claimed, that the intense pressure exerted by a forging machine has no detrimental effect on the material, but makes it more homogeneous and better able to stand a higher stress than the unforged material.

The outstanding features of the "Selson" forging and upsetting machine—John's patent—exhibited at Olympia and illustrated herewith in Figs. 3 and 4 page 266 are as follows:—The drive is effected by a patented rotary key clutch, whereby the only parts operating when the machine is running idly are the pulleys, fly-wheel and driving gears. The crank shaft, and consequently the die and heading slide, are stationary under these conditions, which fact results in a very large saving in wear and tear. This saving is shown by the following example relating to an eight-hour working day with the machine constantly employed:—

Actual blows or upsets per day, say, ..	3000
Revolutions per minute of driving gear on crank shaft	60
Revolutions per day of driving gear on crank shaft	60 × 60 × 8 = 28,800

It will thus be seen that the crank shaft and moving parts are in action approximately only one-tenth of the total time.

There are four keyways provided in the driving wheel, so that the die and heading slides are set in motion in one-quarter of a revolution or less. In machines of other makes this operation may require a full revolution, and in machines of the drop-lock type can take considerably longer, as it is only possible to drop the lock during part of the revolution, and, should the workman miss the correct time, he must wait for another revolution of the crank shaft. In the "Selson" machine it is only necessary, it is claimed, to depress the foot lever and the rotary key finds its own place in the keyway of the driving wheel.

The machine is provided with four safety breaker bolts, which are situated (*a*) in the fly-wheel to prevent general overload of the machine; (*b*) in the connecting-rod coupling the crank shaft to the heading slide to operate in case too much material is allowed for heading; (*c*) in the toggle system for gripping the dies in case too large a size of material be used or any substance fall between the dies; and (*d*) in the toggle system in case the side pressure after the dies are closed should be too great.

The back stresses of the machine are absorbed by the clutch and are not transmitted to the operator should he allow his foot to remain on the operating foot lever. Safety is ensured to the operator when changing the dies or oiling the machine by the provision of safety pins which prevent the clutch from operating until the pins have been withdrawn. An adequate lubrication system is provided throughout, the oil grooves in the heading and die slides being fed from large oil wells cast on the top strips. The revolving parts are oiled by lubricators and the link pins are arranged with oil reservoirs at the top.

The method of operation is as follows:—Several bars are heated in a furnace and the operator, placing one in the machine, holds it close to the right-hand die against a stop which has been previously adjusted to the desired length. He then starts the machine by depressing a foot lever and the heading slide commence to move, pushing aside the stop in its forward motion. During the first portion of its stroke the dies are closed by a link toggle system and the work is firmly gripped between them to resist the pressure of the blow. The tool, mounted on the front of the heading slide, then comes into operation and makes the forging by forcing the hot metal into the cut-away portion of the dies. Thereafter the slide begins its backward stroke, during which the dies reopen and release the work. The slide comes automatically to rest at the back dead centre, enabling the operator to remove the work without danger. Continuous blows can be given, if desired, for exceptionally heavy work by throwing the disengaging stop out of action.

For many classes of work two or even three operations can be carried out at the same heat and with the same pair of dies. In such cases the operator, after the dies reopen, transfers the work from the first to the second position, depresses the foot lever, forges the second operation and afterwards the third in a similar manner. After the forging has been completed it is cut to length on a hot saw or by the shears which form an integral part of the machine.

ALFRED HERBERT, LIMITED.

Gear Measuring Machine.—On the stand of Alfred Herbert, Limited, of Coventry, the Wickman gear measuring machine—illustrated in Fig. 14 and in detail in Fig. 15—is being shown. This machine enables errors of division and errors of concentricity and parallelism in gear wheels to be differentiated, an accomplishment, it is said, which is not possessed by any other gear testing machine. It is, therefore, claimed to be the only machine which can correctly diagnose gear trouble; all other machines merely showing that inaccuracies exist but not what they actually are. The machine is very rapid in action and is fitted with an automatic recorder. A chart, which is printed automatically during the rotation of the gear, shows immediately whether the work is within a predetermined standard of accuracy or not. This chart may have two black lines ruled on it, and if the errors are so small that the printed record is entirely between the two lines the gear can be passed as satisfactory.

The theory of the machine is very interesting. Its standard of reference is not an arbitrary standard such as the inch, but is simply a circle which it can divide into any number of divisions, spaces or teeth. If the record of tooth spacing on the chart is a straight line then all the divisions are exactly alike and the gear is perfect. If, similarly, the record of concentricity is a straight line, there is no error.

The indicating mechanism is shown diagrammatically in Fig. 16. The stylus at A is mounted on a flexible spring steel plate .006in. thick, and is free to move in any direction in a horizontal plane—that is to say, backwards or forwards, or axially.* The gear is located by a locking bolt B, which also swings on flexible spring-steel plates with a true straight line movement. The stylus is set in the next space to that occupied by the locking bolt and the indicators are set to zero. The gear wheel is rotated one tooth at a time, and each tooth space in turn is located by the locking bolt. Simultaneously, the stylus in the next tooth space rocks out of that space into the next, the position of the indicators being affected by its position relatively to the locking bolt and to the first setting.

The new position of the stylus can be (1) the same as the first or zero setting; the indicators will again read zero. (2) Directly in front of, or behind, its former position; only the concentricity indicator C will be affected. (3) Twisted to one side of its former position; only the tooth spacing indicator D will be affected, or (4) both twisted to one side and moved axially; both indicators will be affected. In (1) the two points of contact between the stylus and tooth space will be exactly the same distance from the centre of the gear and from the locking bolt as in the first tooth space. In (2) the new space is nearer to, or further from, the centre of the gear, but is the same distance from the locking bolt. Thus, while the tooth spacing is correct, there is a concentricity error. In (3) the concentricity is correct, but there is an error in tooth spacing. In (4) both concentricity

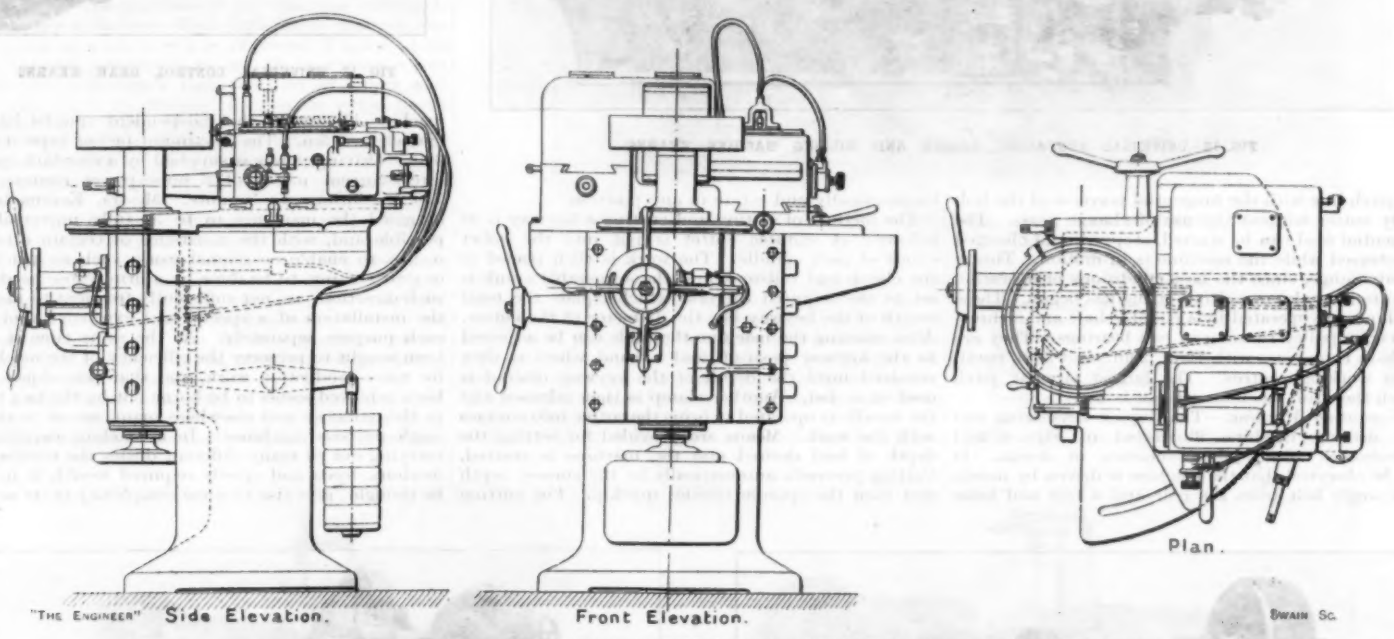


FIG. 14—ELEVATION AND PLAN VIEWS OF THE WICKMAN GEAR MEASURING MACHINE—ALFRED HERBERT

* For a note on this form of frictionless support see an article on the Wickman gauge measuring machine published in our issue of March 9th, 1923.

and tooth spacing are in error. Because of the fact that erratic tooth spacing will also affect the concentricity indicator, since a wider or narrower space will make the stylo move axially, the concentricity indications cannot be relied upon when the tooth spacing indications are erratic. The division record must assume a smooth curve before the concentricity record can be read correctly.

The machine consists of a column, on the front of which is a counterweighted vertical slide. The gear wheel to be tested is mounted on a rotatable arbor held in the vertical slide. On the top of the column are two adjustable heads; one carries the locking bolt, the other the flexible stylo and the recording mechanism which is actuated by Bowden cables from the controlling wheel. The star wheel on the front of the vertical slide controls the whole of the operations; it first prints the position of the two indicators on the chart, then withdraws the locking bolt, rotates the gear until the locking bolt drops into the next tooth space and repeats the process. When the gear has made one revolution, the chart is taken out and inspected.

An erratic tooth spacing curve condemns the gear at once and steps must be taken to improve the division of the gear cutting machine. A smooth tooth spacing curve, even though the variation from the zero line is considerable, is better than one with less variation from the zero line but with violent jumps. If the tooth spacing curve is fairly smooth the concentricity curve can be examined. To a slight extent it will be affected by the tooth spacing curve, but it readily shows how concentric the gear is. The machine can accommodate gear wheels up to 12in. diameter by 3in. face.

Among the mechanical details of the machine attention may be directed to the double spring and needle connections E F, Fig. 16, forming links in the indicating mechanism. Similar connections are to be found in the Wickman gauge measuring machine which was described in THE ENGINEER on March 9th, 1923. The abutment connection at G is provided, as shown in Fig. 15, with a set screw for adjusting the zero position of the concentricity indicator. The frictionless pivots H are worthy of particular attention. As shown in Fig. 17 they consist each of two angle pieces, one of which is anchored rigidly to the machine framework, the other being connected to the first by means of two pairs of crossed flexible steel straps which permit the second angle piece and the lever attached to it to swing freely about an imaginary axis substantially coincident with the vertical line formed by the intersection of the planes of the two pairs of straps.

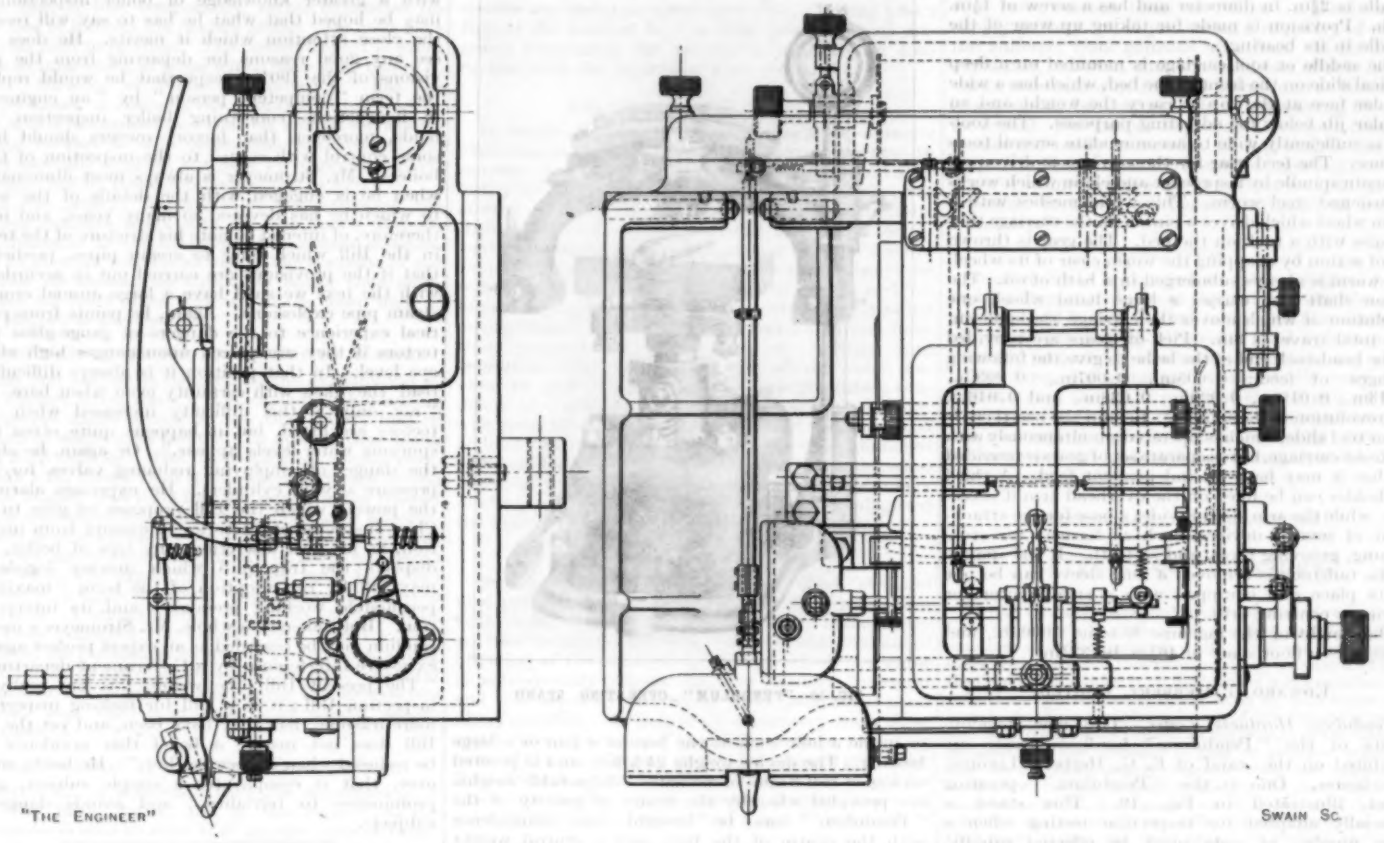


FIG. 15—ZERO ADJUSTING ARRANGEMENT OF WICKMAN GEAR MEASURING MACHINE—ALFRED HERBERT

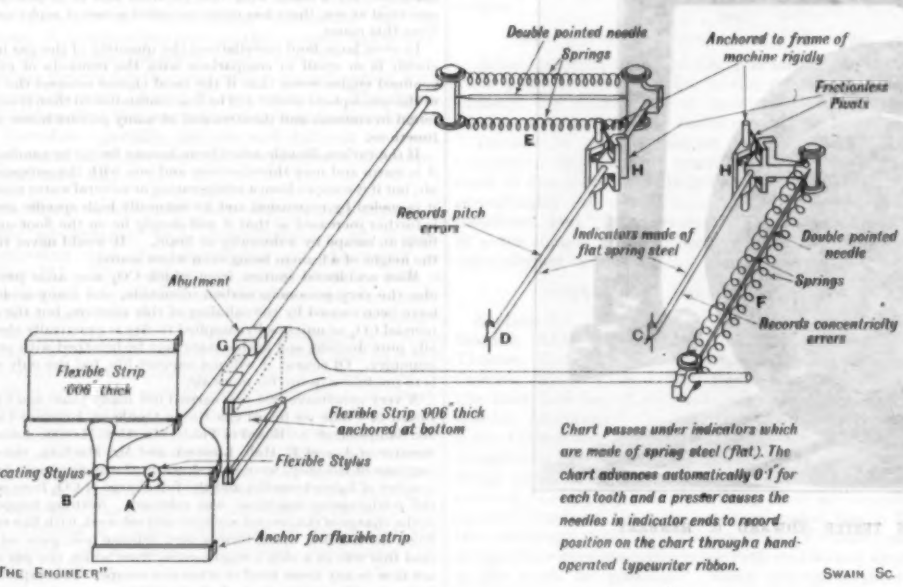


FIG. 16—DIAGRAM OF INDICATING MECHANISM—ALFRED HERBERT

JONES AND SHIPMAN, LIMITED.

Stub Lathe.—One of the most noteworthy machines on the stand of A. A. Jones and Shipman, Limited, Leicester, is the Sundstrand "Stub" lathe illustrated in Figs. 5 and 6, page 266 from which it will be seen that the machine is intended essentially for short heavy work, and we presume that this is the reason for its name. One of the peculiar features about the lathe, which, by the way, has a swing of 8in. over the saddle and will take 11in. between the centres, is an overhead arm that ties the head and tailstocks together, much in the same manner as in a milling machine. This arm is 3¼in. in diameter, but it is only one of several precautions which have been adopted to ensure that the machine is as rigid as it is possible to make it.

The headstock is cast solid with the bed, and through it there runs a mandrel over 31in. long. At the front end there is a taper bearing 6in. long and 4¼in. in diameter at the big end. The rear bearing is 3¾in. by 4in. and both can be taken up by a single nut at the rear end of the spindle. The nose is 4in. in diameter with a ¼in. pitch thread, and there is a hole $1^{13}/_{32}$in. in diameter right through the spindle. The drive is effected through a bronze worm wheel and worm driven from the main shaft through change gears arranged in the case which can be seen in the front of the machine. The worm gives a reduction in speed of 8 to 1 and the change wheels allow spindle speeds ranging from 30 up to 192 revolutions per minute to be obtained. If the machine is to be used for brassfinishing or similar work which requires a high speed a special worm gear giving a 3 to 1 ratio is provided. The main shaft is driven by belt by a motor housed in the base of the machine. The horse-power

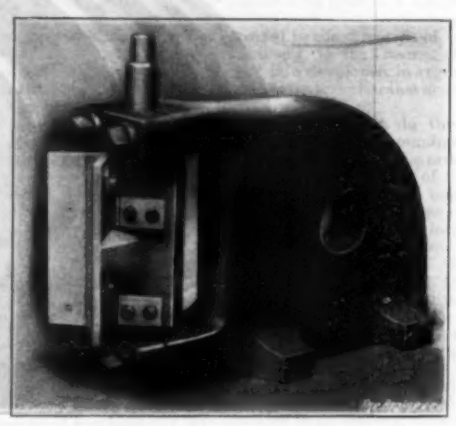


FIG. 17—FRICTIONLESS PIVOT

of this motor ranges from 5 up to 15, according to the work to be done.

The tailstock, it will be noticed, is primarily supported by the overhead arm already mentioned, but it is also tied back to the bed below by means of a bracket and stud. A set of collars or distance pieces is used in connection with this stud for fixing the tailstock in the position required for the work in hand. The movement is effected by sliding the overhead arm through the headstock, and for this purpose it is provided with a rack and pinion. The tailstock spindle is 2¾in. in diameter and has a screw of 1¼in. pitch. Provision is made for taking up wear of the spindle in its bearing.

The saddle or tool carriage is mounted on a deep vertical slide on the front of the bed, which has a wide angular face at the top to carry the weight and an angular jib below for adjusting purposes. The toolbox is sufficiently wide to accommodate several tools at once. The feed gear for the carriage is driven off the main spindle by a sprocket and chain which works a hardened steel worm. This worm meshes with a worm wheel which drives a pinion on the carriage that engages with a rack on the bed. The gear is thrown out of action by dropping the worm clear of its wheel. The worm is always submerged in a bath of oil. The pinion shaft also carries a large hand wheel, one revolution of which moves the carriage through 4in. The total travel is 8in. Pick-off gears are provided at the headstock end of the lathe to give the following changes of feed:—0.005in., 0.007in., 0.009in., 0.013in., 0.019in., 0.029in., 0.038in., and 0.046in. per revolution of the spindle. Behind the bed there is a rear tool slide, which is operated simultaneously with the front carriage, but a separate set of gears is provided so that it may have an independent feed. A third toolholder can be fixed on the overhead arm if necessary, while the arm also provides a base for the attachment of several devices, such as formers for cross turning, grooving tools, and so forth. If the spindle of the tailstock is removed a long sleeve can be put in its place and equipped with a small motor for driving a centring drill.

The weight of the machine is some 3000 lb., and it occupies a floor space of 46½in. by 33½in.

EDWARD G. HERBERT, LIMITED.

Pendulum Hardness Tester.—Two new developments of the "Pendulum" hardness tester are exhibited on the stand of E. G. Herbert, Limited, Manchester. One is the "Pendulum" operating stand, illustrated in Fig. 19. This stand is especially adapted for inspection testing when a large number of tests must be effected rapidly. It also enables "time tests" to be made without previous practice. The standard "Pendulum" tester is used, and the operation is entirely mechanical. Slight movements of one handle serve (1) to release the table and allow it to rise until the "Pendulum" swings gently on the work; (2) to operate the stop watch, and (3) to lower the table and replace the "Pendulum" on its three-point support. The arm supporting the "Pendulum" can be raised to admit specimens up to 6in. deep. The table is mounted on a plate which rests on three levelling screws. It can be replaced by special fixtures for testing irregularly shaped work. The standard "Pendulum" can be used to make time tests with this stand, and also to make "scale," "work-hardening" and temperature tests by hand operation.

The second development is the 24-kilo. "Pendulum" hardness tester, shown in Fig. 18. This "Pendulum" is identical in principle with the standard 4-kilo. tester, but is adapted for testing very large work. With it hardness tests can be made on shafts or rolls up to 30in. in diameter, at any point on plates or other flat surfaces up to 30in. wide, at any point on the face of gear wheels, or drums of any diameter and up to 30in. wide,

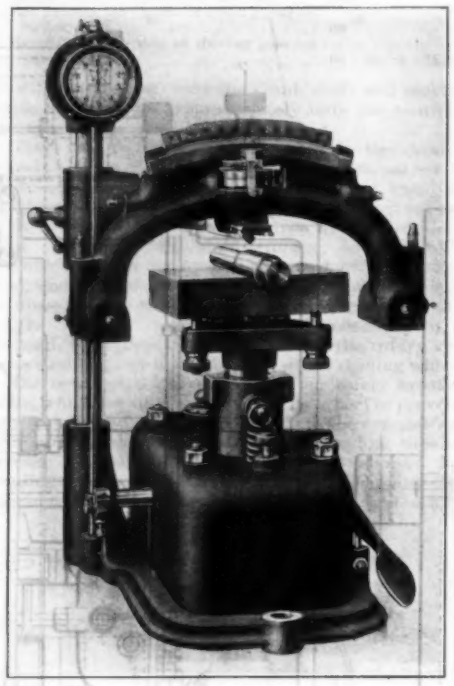


FIG. 19—"PENDULUM" OPERATING STAND

or inside a hole such as the bore of a gun or a large bearing. The device weighs 24 kilos., and is pivoted on a steel ball 3 mm. in diameter. Adjustable weights are provided whereby the centre of gravity of the "Pendulum" can be brought into coincidence with the centre of the ball, and a central weight mounted on a micrometer screw provides the means for adjusting the "length" of the "Pendulum." The 24-kilo. tester is adapted for making time tests for indentation hardness, and scale tests for work-hardness, and for measuring the work-hardening capacity of metals.

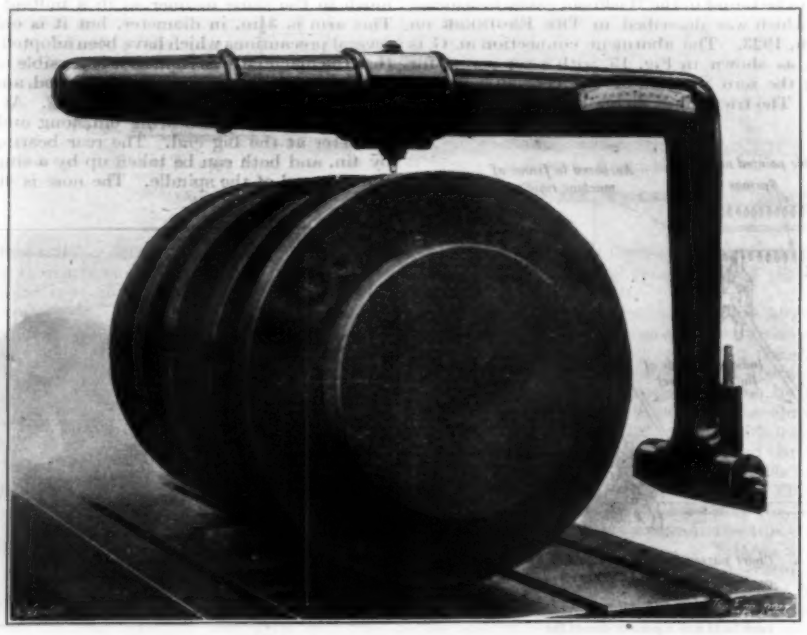


FIG. 18—24-KILO "PENDULUM" HARDNESS TESTER—EDWARD G. HERBERT

IMPERIAL Airways is now issuing monthly traffic returns. The receipts for July amounted to £42,520, as against £27,398 for June. The aggregate receipts since April 1st total £83,189. The miles flown during July amounted to 146,840, compared with 99,710 in the previous month, bringing the aggregate to 294,490, while ton miles for the month were 72,827, against 47,353, making a total since April 1st of 145,810.

Steam Boiler Inspection.

THE 1923 Memorandum of the Chief Engineer (Mr. C. E. Stromeyer) to the Manchester Steam Users' Association is devoted entirely to the consideration of the steam boiler clauses of the Factory Bill which is now engaging the attention of the Government. Mr. Stromeyer examines that section of the Bill with meticulous and, sometimes, rather hypercritical care, but as there are few, if any, men with a greater knowledge of boiler inspection, it may be hoped that what he has to say will receive the close attention which it merits. He does not see any good reasons for departing from the provisions of the 1901, except that he would replace the term "competent person" by "an engineer" in instructions concerning boiler inspection. He holds, moreover, that factory owners should have some control with regard to the inspection of their boilers. Mr. Stromeyer is always most illuminating when he is engaged with the details of the work to which he has devoted so many years, and it is, therefore, of interest to note his stricture of the terms in the Bill which refer to steam pipes, predicting that if the provisions are carried out in accordance with the text we shall have a large annual crop of steam pipe explosions. Again, he points from practical experience to the dangers of gauge-glass protectors if they are placed upon gauges high above eye level. In that position it is always difficult to read the glass with certainty even when bare, and "not only is this difficulty increased when protectors are fitted, but it happens quite often that spurious water-levels appear." Or again, he shows the danger of employing reducing valves for low-pressure drying cylinders. He expresses alarm at the powers which the Bill proposes to give to the Chief Inspector of Factories to exempt from inspection, at his own discretion, any *type* of boiler, and displays the trap into which unwary legislation may fall by the adoption of the term "maximum permissible working pressure" and its interpretation. But, taken as a whole, Mr. Stromeyer's memorandum may be regarded as an expert protest against excessive interference by a Government department. "The present Bill," he writes, "is not really an inspection Bill; it is a Bill for making inspections more irksome than they have been, and yet the new Bill does not inspire a belief that accidents will be reduced when it becomes law." He holds, moreover, that it complicates a simple subject, gives prominence to trivialities, and avoids dangerous subjects.

Letters to the Editor.

COLD STORAGE DANGERS.

SIR,—My attention has been called to a paragraph in your Seven-day Journal of August 15th last, under the above heading. From your remarks the uninitiated might be led to suppose that there is after all some foundation for the fear which has long since been proved groundless that there might arise danger to human life from the CO_2 gas escaping from a badly constructed machine working with this medium.

That such is not the case is amply proved by the fact that, although on this side of the Atlantic the majority of refrigerating machines are worked with this medium and it is practically universal at sea, there has never occurred a case of asphyxiation from this cause.

In even large land installations the quantity of the gas in the circuit is so small in comparison with the contents of even a confined engine-room that if the total charge escaped the state of the atmosphere would still be less contaminated than is usually found in cinemas and theatres and at many private house social functions.

If the carbon dioxide arises from human beings or combustion it is warm and may therefore rise and mix with the surrounding air, but if it escapes from a refrigerating or mineral water machine it is cooled by expansion and its naturally high specific gravity is further increased so that it will simply lie on the floor until it finds an escape by a doorway or drain. It would never rise to the height of a human being even when seated.

Most accidental sources from which CO_2 may arise produce also the very poisonous carbon monoxide, and many accidents have been caused by the inhaling of this mixture, but the commercial CO_2 as universally supplied to-day is practically chemically pure dioxide, and in this state may be breathed with perfect impunity. Of course, it will not support life, but the only effect is to produce a desire for more air.

A very conclusive test was carried out many years ago by the Board of Trade on board the Union Castle ss. Braemar Castle. Mr. Sampson, of he Board of Trade, Mr. Alex. Marcet, thanaging director of J. and E. Hall, Limited, and Mr. MacKay, the chief engineer of the ship, were shut down in the engine-room with a number of lighted candles and the full charge of CO_2 from one of the refrigerating machines was released. Nothing happened, so the charge of the second machine was released, with like result. Even the candles, which form a very delicate test, gave no sign. And this was in a ship's engine-room from which the gas could not flow to any lower level or otherwise escape. This experiment is frequently repeated, and it is quite common practice to blow out the charge of the largest size machines used on meat-carrying vessels without any notice being taken by the men around it.

I have not been able to secure a full report of the inquest you refer to, but as it might be understood from your comments that Sir Bernard Spilsbury had attributed the death of the man to the CO_2, which apparently had been escaping from the refrigerating machine on which he was employed, I trust you will give me this opportunity of correcting the erroneous impression that might arise and so tend to impair the absolute confidence which users justly feel in the safety of refrigerating machines operating with this medium.

A. H. TYLER, M.I. Mech. Eng.

Leytonstone, E. 11, September 3rd.

Metropolitan Water Board: Eighteenth Annual Report.

THE eighteenth annual report made by Sir A. C. Houston to the Metropolitan Water Board on the results of the chemical and bacteriological examination of the London waters for the twelve months ended March 31st, 1924, has recently been published. In his opening paragraph Sir Alexander says that he feels that he has, temporarily, rather exhausted his abilities to interest his readers afresh. He need have had no such misgivings. The present report is every whit as interesting as those which have gone before it. The "Director of Water Examination" has the happy knack of chaining the attention of his readers, and it is a recognised fact that his annual reports are looked forward to with pleasurable anticipation and most carefully studied, not only by engineers in this country, but by those of other nations as well.

In the present Report, after recapitulating the leading matters dealt with in last year's Report, Sir Alexander divides his subject into sixteen sections, and to give our readers an idea of the contents of the volume we cannot, we think, do better than summarise the brief notes with which the main bulk of the Report is prefaced.

CHLORINATION OF THE THAMES RIVER WATER.

The first section is devoted to the chlorination of the Thames River water. It is explained that during the period under review no less than 24,277 million gallons of water were treated, the average dose being 1 in 2.42 millions. The bacteriological results were, we are told, better than if the water had been stored in the Staines reservoirs for over a month, the treated water was quite innocuous, and there were no complaints as regards taste. As a result of the treatment there was an estimated saving of £14,200 as compared with what the expenditure would have been had the same volume of water been pumped into the reservoirs. During the eight years that the treatment has been practised the average dose was 1 in 2.3 millions, the percentage number of samples containing no *B. coli* in 10 c.c. of water was 78 per cent., the total volume of water treated was nearly 185,000,000,000 gallons, and the gross calculated saving nearly £120,000.

CHLORINATION OF THE NEW RIVER WATER.

Section II. is concerned with the chlorination of the New River water, and in this connection Sir Alexander is able to state that another year of treatment having passed, "it is a great thing to be able to say" that it is now possible to remedy the bacteriological deterioration of the water during the winter floods and that without giving rise to taste troubles. Five thousand two hundred and thirty-seven million gallons were treated at a nominal cost of £388. In point of fact a great saving is involved, as the interest on the capital expenditure for remedial works to render the New River pure during floods would far exceed the small sum required for chlorination. The average dose was 1 in 3.07 millions, and the success of the treatment may be judged from the following:—During November, December and January—normally the flood months of the year—the New River *filtered* water *previous* to chlorination contained, on the average, *B. coli* in 40 per cent. of the samples examined, while the average *raw* water colour was 58. The corresponding figures for the year under consideration with chlorination were 14 and 95 respectively. The figure of 95 shows that the *raw* water was highly discoloured and therefore specially impure and difficult to treat. Yet, instead of 40 per cent. *B. coli* positives, the number was only 14.

SUPER-CHLORINATION AND DE-CHLORINATION.

The advantages and disadvantages of super-chlorination and de-chlorination are discussed in Section III. The advantages are that even with a short period of contact sterilisation can be made effective, and that it is possible by its use to escape serious taste troubles. The disadvantages are that the cost of the treatment is considerable, and in some cases may be even prohibitive, and further, that it entails much more careful supervision than ordinary chlorination methods. Although at Ferry-lane there was a slight setback in the second experiment for reasons at present unknown, the first experiment, which lasted for fourteen days, was an unqualified success. A super-dose of chlorine of 2 to 1 million—1 in 500,000—was employed, followed by de-chlorination, without a single complaint of taste and the production of a water uniformly containing no *B. coli* in 100 c.c.

SUSPENDED SOLIDS IN THAMES RIVER WATER.

In Section IV. it is explained that since November, 1920, the suspended solids in Thames River water have been determined gravimetrically. During the week ended January 27th this year every million gallons of raw Thames water carried with it 540 lb.—nearly 5 cwt.—by weight of suspended matters, 434 lb.—nearly 4 cwt.—of which were non-volatile When it is remembered that at such periods every 4 million gallons of water allowed to enter the reservoirs carries with it nearly a ton of solid matter, the importance of closing the intakes temporarily is self-evident. Dividing the year into weeks above and below 100 lb. of solids in suspension per million gallons, the former claims 21 and the latter 31 weeks.

"RESISTANCE TO FILTRATION" EXPERIMENTS.

Section V. treats of the "Resistance to Filtration" experiments with which Sir Alexander's name is particularly associated. By means of his investigations in this direction he is frequently able to predict undesirable algal growths in reservoirs so that steps to arrest them may be taken in good time, and the studies are useful in other directions. In this year's Report the method used is fully described and diagrams illustrating the apparatus employed in connection with the experiments are given.

PRE-FILTRATION WATERS.

In Section VI. we are informed that the systematic examination of all the waters—over twenty in number—began a good number of years ago, but that last year a much more comprehensive study was started which will be continued indefinitely. Although, Sir Alexander remarks, it is a matter for legitimate regret that the sources of London's water supply are not above suspicion, it must always be remembered that *raw* river water is never used for filtration purposes.* Either the water is chlorinated or else stored for many weeks, and sometimes both these processes of purification are brought into operation. The net result is that all the water previous to sand filtration has been brought into a condition of "considerable, if not remarkable, purity. The great mass of pre-filtration water was improved at least ten times, a goodly proportion one hundred times, and a small amount of it actually one thousand times, as judged by the *B. coli* test. A finer eulogy of the precautions taken by the Board to safeguard the health of London could hardly be written."

RAPID FILTERS.

Section VII. shows that at Barn Elms there are nine primary rapid filters, and that they have been kept under observation since January, 1923. They are used to remove the larger solids so that the rate of filtration of the sand filters through which the water is subsequently passed may be thereby increased and the necessity for laying down additional sand filters avoided. As judged by laboratory tests these rapid filters have done excellent work in removing most of the growths and suspended matters generally. Two of the slow sand filters had to be cleaned only three times during the twelve months, despite increased rates of filtration of somewhere about 50 per cent.

GULLS AS A SOURCE OF CONTAMINATION.

In Section VIII. Sir Alexander returns once more to the question of the contamination of water in reservoirs as the result of the visits to the reservoirs of numerous gulls. He states that experiments made to frighten the birds away from one of the Board's works met with considerable success. Gulls, it is remarked, do not, so far as is known, "suffer from the water-borne diseases which afflict human beings; nevertheless, their 'droppings' constitute an embarrassing form of excremental pollution, inasmuch as it cannot, in the light of present knowledge, be differentiated from contamination of human origin."

THE TASTE OF CHLORINATED WATERS.

After making in Section IX. a brief mention of the visit paid to the Board's works by foreign health officers, Sir Alexander, in Section X., proceeds to discuss the question of taste in chlorinated waters. "Taste," he says, "cannot be measured, and is extremely subtle in its manifestations. It is like a thief in the night, prowling around and seeking some opportunity of doing mischief." The chlorinous, iodoform, and "indeterminate" tastes are described at some length and the best ways of avoiding them carefully set forth.

COMPLAINTS FROM CONSUMERS.

Section XI. deals with the "Permanganate Test," Section XII. with "The Condition of the River Thames Water as regards Dissolved Oxygen," and Section XIII. with "The Permanent Hardness of the East London (Lee) Supply," and do not call for special comment. In Section XIV. "Complaints from Consumers" are discussed. The number of complaints received from consumers is described as being remarkably small, having regard to the magnitude of the supply. Only ninety-nine are recorded in the Complaint Book for the year ended March 31st last, although there were others which, for one reason or another, were specially dealt with and do not appear in the book in question. Many points of interest are discussed in this section, *e.g.*, dirty cisterns, milkiness of water, electrolysis, corrosion, worms in water, nuisance from midges, discoloured bath water, &c.

MEDICATED WATER SUPPLIES.

In Section XV. Sir Alexander deals with the addition of sodium iodide to the water supply of Rochester—New York—to which we drew attention in the leading article which appeared in our issue of August 29th. The information which he gives is practically identical with that contained in our article, though it was evidently obtained from a separate source. It is, briefly, that at the town in question sodium iodide in minute quantity is added to the water supply at two periods of the year for several weeks on end with the object, if possible, of rendering the consumers immune from the disease of goitre. "It is," remarks Sir Alexander, "a curious departure from current ideas to 'dope' a whole water supply in the hope of protecting a minority of potential sufferers from goitrous affections. It should be explained, however, that the incidence of this disease varies enormously in different places, and at Rochester it appears to be very prevalent. Assuming that the treatment does act as a preventative and that the results are really successful, it is probable that the majority of consumers will not mind ingesting harmless doses of iodine for a few weeks twice a year, if it proves a benefit to those less happily situated as regards immunity."

CONCLUSION.

Section XVI. is devoted to meteorological notes, and the Report includes at the end not only the usual chemical and bacteriological tables, but also a number of most interesting diagrams and photographs specially prepared to illustrate the text.

The foregoing summary is necessarily very brief and sketchy, though it is hoped that it will serve to show that this year's Report deals with most interesting matters, though it cannot aspire to give any indication of the fascinating language in which those subjects are discussed.

* This statement is qualified by the explanation that it is not quite true as regards the New River, as with it storage is inadequate, but whenever there are floods the water is chlorinated, and the New River during the rest of the year is far purer than the Thames or Lee.

Large Steel Forgings.*

IT may be safely said that investigations of recent years have done much to explore the physical chemistry of the reactions occurring between molten steel and steel-making slags, with the result that in an adequately controlled plant the liquid steel issuing from the furnace is in a satisfactorily refined and purified condition. Even so, such liquid steel is undoubtedly a complex solution of the various elements and their compounds present in the iron, and the ultimate reliability of the ultimate forging or product, whatever may be its form, largely depends upon the subsequent methods of casting and manipulating the steel, since in a complex solution, such as molten steel, the steel does not solidify simultaneously but differentially, with the result that even if care has been taken to exclude shrinkage cavity, yet a certain amount of segregation may be encountered which is negligible or serious, according to its degree and position in the ingot in which it occurs. However, the manner in which ingots of varying shapes are likely to freeze has been thoroughly investigated, and the facts taken into consideration in the design of suitable moulds. The influence of casting temperature has been studied, and the effect of this factor is now, in the best practice, fully appreciated, and the casting temperature is modified according to the nature and the mass of steel which is being cast. If a forging made from even an ideally manufactured ingot is sectioned, and the sectioned surface suitably etched, it will be found that the flow of metal during the forging or hot-working operation can be studied by means of a definite structure developed by the etching medium. This structure is largely produced by the very small non-metallic inclusions which are unavoidably present in any steel which has been cast, particularly in large ingot size. It is, however, important that the engineer should appreciate the direction of flow in a forging from which he produces his finished part, since the material can be much more severely stressed in the direction of the flow of the metal than transversely to it; hence, the interest which engineers have of late developed in regard to the strength and ductility of steels tested transversely or tangentially.

The bigger the ingot, the more important do these questions of segregation and complete ingot soundness become. For instance, in a relatively small ingot the order of freezing can be pre-arranged, but when ingots of 60, 70 and 100 tons and more are cast, the engineer must realise that whilst, in the first place, it is really a feat on the part of the works organisation to produce such a large mass, yet having produced that mass, it becomes far more difficult to guarantee its homogeneity. Yet one of the most noticeable features of modern engineering is the blitheness with which engineers will legislate for the use of larger and larger masses of steel. This is, for instance, nowhere better illustrated than in the case of the construction of turbines. It is within the author's knowledge that forgings are produced from masses so large that it is difficult for the works staff engaged in producing the steel to guarantee that such large parts shall have the degree of homogeneity and freedom from internal defects which is necessary for complete safety. It will be well that engineers should learn that they would be far safer to build up a part of smaller masses rather than push the ability of the steel works, as regards the production of the largest masses, to the fullest extent. Even the best steel, relatively free though it may be from impurities, still contains essential elements which segregate during slow freezing with the production of a heterogeneity which is undesirable. In, therefore, attempting to describe modern developments in special steel metallurgy, the author feels that he would be missing an important point if he did not indicate a very serious direction in which apparently the laws of nature limit satisfactory manufacture.

Whilst speaking of such matters, the author might usefully refer to such parts as nickel steel pinions, gear wheel rims, and rotor shafts, which are amongst the most important units in modern engineering. It is essential

* From a paper by Dr. W. H. Hatfield, presented at the Empire Mining and Metallurgical Congress.

that adequate steps should be taken during manufacture to check the mechanical reliability of such parts. That the intrinsic mechanical properties of the material in each case are reasonably good is easily determined by taking mechanical tests of various kinds from various portions in the forging, whatever it may be. As regards pinions, when they are of large dimensions, and the rotor shafts, it is desirable to put a hole through along the axis, which permits of an examination to make sure that there are no shrinkage cavities or defects arising from excessive segregation. As regards the body of the forging, it is common practice in the works with which the author is associated to cut full-sized discs, which are polished and then etched with suitable etching media, which will disclose or otherwise the presence of any heterogeneity which is undesirable. Detailed examination of the material on these lines is naturally expensive, and adds materially to the cost of production, but the author feels that such procedure is warranted by the undoubted advantage of knowing that such parts are as reliable as human ingenuity can provide. The advantage of such investigations is proved by the fact that at times forgings are found which disclose a heterogeneity that leads to the discarding of a forging which otherwise might go into service. There have been cases recently of forgings which have failed in service, the defective nature of which could readily have been determined by the methods so adopted.

The heterogeneity to which reference is here made has already been explained as due to differential freezing, the less pure metal freezing last. In very large masses of steel, it is quite clear that the time-temperature conditions permit of this aspect being exaggerated, and it is indeed impossible to produce a large mass of steel in which this natural process of segregation has not taken place to some extent. This means therefore that in most large ingots ghosts, the optical effect of this local segregation, will be observed on machining, and it would therefore be fixing an impossible standard if engineers were to insist on the complete absence of ghosts. At the same time, ghosts, when they do appear, should be carefully studied, and the author has always held in his own mind that if a turning removed from this particular area does not break at the points where the segregate occurs, the ghost may be treated as merely a variation in the normal composition of the steel induced by the slow freezing of a large mass. If the steel has been badly made, then it is realised that, besides the variation in composition, there will also be located in the segregated area oxide products which tend to make actual defects, which cannot be overlooked. It will be clear from these remarks that the reliability of a forging to some extent depends, not only upon the extent of the segregation effects, but also upon the manner in which they lie distributed throughout the finished parts. For instance, the Air Board, with the assistance of the industry, did much to examine the flow of material in aircraft parts, and the results of labours in this direction are to be found in the undoubted materially increased reliability of present-day aircraft units. The same practice is applied to larger parts with much advantage. For instance, taking the large gear wheel rims in reduction gearing, these rims may be either forged to shape at several heats or hollow rolled. A hollow rolling plant will produce such large rims up to 15ft. in diameter. By the use of this method of deformation, the flow of the metal is in conformity with the periphery, and hence the weaknesses induced by the flow of the grain actually running out into the periphery, as is sometimes the case in forged rims, does not arise. Other similar instances could be quoted where a detailed knowledge of the flow of the metal in relation to the finished part can be definitely shown to be one of the most important developments in the metallurgy of modern steels.

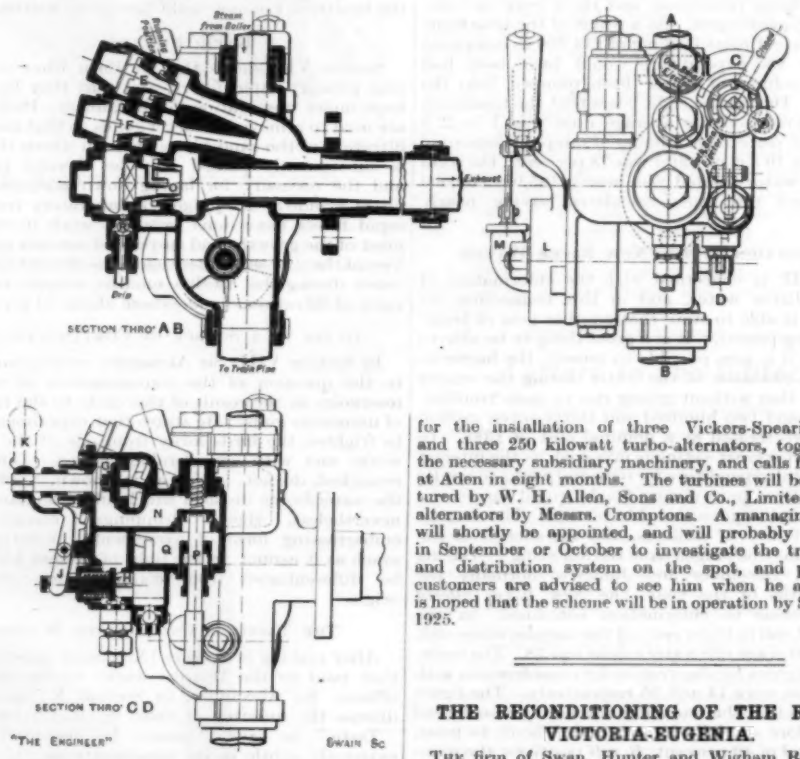
Another very important case is that of turbine discs, which of necessity must be absolutely reliable. It is within the author's knowledge that many discs have in the past been made by producing a flat slab from the ingot, and then cutting discs from the slabs so made. This means, of course, that the zones of segregate and probably ingot unsoundness, run straight across the discs, thus causing planes of much less strength. The best way to make a turbine disc is to produce a cylindrical bloom from the ingot, section it transversely into blocks, and then forge the "cheeses" so produced, with the ingot axis in the vertical position. The material which will then constitute the disc is deformed in such a way that the steel is extended laterally, *i.e.*, at right angles to what was originally the axis of the ingot, and incidentally, the axis of the segregate. This forging of the block into a disc is accomplished at one heat by forging on a mechanically-revolved table, the steel being deformed tangentially, the tool employed ensuring that the steel flows in a radial and also in a circumferential direction. A disc made in this way has the least satisfactory portion of the material in the centre of the disc, and is thus generally removed when the hole is bored. The main point in this method of manufacture is that it produces a really mechanically reliable disc. A proper conception by the engineer of the nature of a large ingot mass of steel is imperative, if he is to satisfy his mind that his important parts have been manufactured to the best advantage.

One, and perhaps the most important, of the modern processes relating to large masses is that of hardening and tempering, and it will be realised that when, with the introduction of alloy steel, hardening and tempering of such masses began, there were great difficulties which had to be overcome. However, in practice if heating be done under proper pyrometric control with a gradual attainment of the high temperatures required, and efficient furnaces to determine uniform heating, it is found that if the quenching is done symmetrically, *i.e.*, uniformly, the dangers of cracking or smashing, through internal stress produced by the hardening, is reduced to a minimum. The hardened forgings are then immediately slowly heated to the tempering temperature, and a reliable mechanical condition of large parts is obtained of high maximum strength and elastic range, coupled with an excellent degree of ductility. It is worth mentioning that to put a hole through any cylindrical forging which has to be hardened and tempered, not only has the advantage of removing the central portion of the ingot, but also by permitting the quenching medium, be it oil or water, to pass up the centre of the forging, minimises the degree of internal stress to which such a cylindrical forging would otherwise be submitted.

The author cannot emphasise too strongly the necessity for the sulphur and phosphorus in the steel, particularly the former, being kept at as low a percentage as possible. It was the tendency during the war, owing to difficulties of supply, to broaden our specifications in some directions with regard to these two elements, but it should always be borne in mind that the sulphur and phosphorus segregate badly in large masses of steel, and the sulphur in particular is invariably present—not alloyed with the steel, but in the form of non-metallic inclusions as sulphide. Such sulphide, therefore, simply behaves as included dirt, and tends locally to produce mechanical weakness. There is therefore every ground for insisting that the steel used in the production of the important parts used in modern engineering, particularly in power plants and transmission parts, should be as free from sulphur and phosphorus as commercial considerations will permit.

An Improved Ejector for Vacuum Brakes.

WITH the object of reducing the amount of steam required for maintaining the vacuum throughout the brake systems of average trains, Gresham and Craven, Limited, Manchester, have patented and put on the market a combination ejector to which the name of Gresham's "Super-Dreadnought" has been given. As railway engineers are aware the ejectors hitherto employed have been fitted with two sets of nozzles, one small nozzle for maintaining a vacuum of about 20in. of mercury throughout the brake system, and one large nozzle for recreating the vacuum quickly after an application of the brakes. It has, however, been found that with reasonably "tight" trains a still smaller steam nozzle is sufficient for all ordinary purposes. Instead, therefore, of providing



SUPER-DREADNOUGHT EJECTOR.

two steam nozzles in the new ejector there are three nozzles, one of 30 mm. bore, and the other two of 15 mm. bore each, both the latter being controlled by one steam valve—as shown in the accompanying sectional drawings. In these drawings E and F indicate the two small ejectors, and O the large ejector. The small ejectors are operated by the steam valve G, the two nozzles being together somewhat more powerful than the present small one. The makers claim that when one only of these ejectors is used the amount of steam consumed is about 44 per cent. less than in previous types of ejectors, and that when both are brought into service their combined power will be about 12 per cent. greater than with the older instrument. Besides effecting an economy in the steam consumed, the new arrangement will also serve to indicate whether or not the brake system of the train on which it is employed is reasonably air-tight.

Another feature of the Super-Dreadnought ejector is the air-lock arrangement H, the object of which is to prevent any steam or moisture passing into the train piping. In the original appliance the air lock is opened to the atmosphere by means of a ball valve which automatically falls from its seating when the vacuum in the train pipe is destroyed, and this ball requires to be kept clean, so that there shall be no liability of its sticking upon its seating. In the new ejector the air lock is opened to the atmosphere mechanically by means of the lever J, which lever is in turn operated by the same handle K, which controls the supply of steam to the small ejector. By this method a much larger opening for the atmosphere to enter the air lock is presented—a decided advantage, especially in cases in which the steam and clack valves of the ejector are not in a perfect condition.

Other features of the Super-Dreadnought ejector, such as the application handle L and the auxiliary valve M for service "applications" of the brake, are identical with those hitherto fitted. The new steam valve G is a bronze disc with two ports, through which the steam passes to the small ejectors. This valve is operated by the handle shown, and is kept tight on its seat by the pressure of steam in the chamber N. P is the main steam valve for the large ejector, which comes into operation when the application handle is in the "brake off" position. Q is the steam chamber for the large ejector, and R is the drip valve fitted with a brass ball. The new ejector has been designed to utilise the same fittings as the present standard Dreadnought ejector, so that in making a replacement no alterations will be found necessary in this respect.

ELECTRICITY SUPPLY FOR ADEN.

THE Executive Committee of the Aden Settlement, having obtained a license under the Indian Electricity Act to supply electricity in the Settlement and Cantonment of Aden, has had a scheme prepared by its consulting engineers and agents, Messrs. Barry, Wolfe Barry and Messent, of 2, Queen Anne's-gate, Westminster, London. The scheme put forward by them has been adopted and will be financed by means of a loan obtained from the Government of Bombay.

High-pressure three-phase alternating current will be generated at 6600 volts, 50 cycles, and will be transformed down for supply to customers in the shape of three-phase four-wire alternating current at 230 volts per phase. The maximum charges to consumers which are permissible under the license are: (1) for general supply purposes for lights, fans and heaters, 6 annas a unit; (2) for power purposes, 4 annas a unit, with a minimum monthly charge in each case of Rs. 3-8-0 per month. The tender of Crompton and Co., Limited, for the power-house and its plant has been accepted by the Executive Committee. The tender provides for the installation of three Vickers-Spearing boilers and three 250 kilowatt turbo-alternators, together with the necessary subsidiary machinery, and calls for delivery at Aden in eight months. The turbines will be manufactured by W. H. Allen, Sons and Co., Limited, and the alternators by Messrs. Cromptons. A managing engineer will shortly be appointed, and will probably visit Aden in September or October to investigate the transmission and distribution system on the spot, and prospective customers are advised to see him when he arrives. It is hoped that the scheme will be in operation by September, 1925.

THE RECONDITIONING OF THE REINA VICTORIA-EUGENIA.

THE firm of Swan, Hunter and Wigham Richardson, Limited, Wallsend, has just completed a remarkably quick piece of work in repairing the Spanish mail steamship Reina Victoria-Eugenia. This ship is owned by the Compania Transatlantica of Barcelona, and runs in that company's service to Argentina. She recently suffered collision in Buenos Aires, when several frames and shell plates on the port side were bent, and the forward port propeller was carried away. There, was naturally, very severe foreign competition for the job of repairing the ship and reconditioning the hull and engines, but the owners decided to entrust the repairs to Swan, Hunter, and Wigham Richardson, Limited, who built and engined the ship at their Neptune Works, Newcastle-on-Tyne, about twelve years ago. The confidence of the owners would appear to have been justified, for the whole of the work which was required to be done was completed, we learn, within a month. The reconditioning included re-polishing most of the woodwork in the first-class public rooms and repainting them. Furthermore, the whole of the telephone and electric lighting installations were overhauled, and all the boats and life-saving appliances put in order.

The propelling machinery of the Reina Victoria-Eugenia is particularly interesting, as it comprises a combination of reciprocating engines and turbines, which arrangement was designed to effect economy in coal consumption. The two inner propellers aft are each driven by a set of four-crank triple-expansion reciprocating engines, balanced on the Yarrow, Schlick and Tweedy system, while the two engines exhaust direct into two low-pressure Parsons turbines, which drive the two forward propellers. The turbines were opened for the first time since their original installation, and, we understand, that they were found to be in perfectly good order. The Reina Victoria-Eugenia is a liner of 10,000 gross tons, and is designed for a speed of about 18½ knots. She is 500ft. in length, with a breadth of 61ft., and she carries over 2000 passengers, including 250 first-class, 100 second-class, and about 1800 third-class passengers and emigrants.

SIXTY YEARS AGO.

SINCE we refer briefly this week to Mr. Stromeyer's annual report to the Manchester Steam Users' Association, it is of particular interest to note that in our issue of September 2nd, 1864, we devoted considerable space to a monthly report made by his predecessor, Mr. L. E. Fletcher, to the same body, which was then known as the Manchester Steam Boiler Association. In this report special attention was given to the failure of a vertical multitubular internally fired boiler which, when only six months old, exploded at the Vauxhall Foundry of Forrester's at Liverpool. It was not under the inspection of the Association, but Mr. Fletcher had had an opportunity of examining it after the accident. He formed the opinion that the boiler was well made of sound material, that there was no evidence of low-water and sufficient evidence that the safety valves, of which there were three, were effective. Why the boiler exploded was, therefore, a mystery. An interesting point is that Mr. Fletcher condemned the practice of locking up safety valves and never testing them for freedom of action. He held that all safety valves should be provided with "ticklers." Mr. Fletcher's good advice has not been consistently followed, and there are many locomotives nowadays with safety valves that cannot be tickled. Had the safety valve of the locomotive which blew up at Buxton been "tickled" periodically, that accident would never have occurred. . . . Our correspondent from the Northern and Eastern Counties reported in the same number that "the old and well-known colliery and ironworks at Wylam are to be sold or let. The property belongs, and has done for many years, to the Blackett family." The two names recall much that is of interest to those who follow locomotive history. Blackett was one of the pioneers of railways, for it was his search for something better than horses to draw coals from Wylam to the Tyne, five miles away, that led William Hedley, his viewer, to construct the "Puffing Billy" of 1813. The engine, after various modifications, worked up till 1862—two years before the sale referred to by our correspondent—and its sister, the Wylam Dilly, worked till 1867. The former is now at South Kensington, and the latter in the Edinburgh Museum. Wylam, we need not remind our readers, was the birthplace of George Stephenson

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Conditions.

THE active autumn demand which has long been hoped for by Midland iron and steel masters has not yet made its appearance though, it must be admitted, at the weekly meeting in Birmingham to-day—Thursday—some increase of activity, both in manufacturing and in buying, was observable. The orders on hand at the principal Midland and Staffordshire iron and steel consuming works probably do not run to a longer period than a month, and practically all their demands for material at the present time are for immediate delivery. Pig iron sold a little more freely, as did some descriptions of steel, but there was no development of moment. Speculation as to the future is rife, but a note of subdued optimism still persists.

Raw Iron.

Midland pig iron upon the whole is much stronger in the market than that of other districts, and whereas there has been for the past week or so, and still is, a slightly improved demand for both forge and foundry sorts in this area, reports of the blowing out of additional furnaces in the Middlesbrough district would indicate a less rosy position in that neighbourhood. Though this week there has been no additional development of the buying movement in the pig iron department, Midland smelters hold the belief that there are better times ahead. At the moment consumers hesitate to commit themselves in regard to raw material. They await more tangible indications of autumn trade revival. Pig iron prices remain nominally unaltered. Northampton foundry iron is firm at the standard of £4 2s. 6d. at furnaces, whilst for Derbyshire £4 5s. to £4 7s. 6d. is being quoted. North Staffordshire makes command £4 10s. For forge iron Northamptonshire smelters are asking £3 17s., Derbyshire about £4, and North Staffordshire £4 2s. The price cutting which prevailed down till recently is no longer in evidence, but efforts to stiffen up prices meet with very little encouragement.

Steel.

The steel trade, as a whole, continues to be far from well employed, though Midland firms are considered to be doing a little better than those in some other districts. Prices are very weak, the business passing being too meagre to give stability to the market. Though the association standards are officially maintained these have for some time past been well above the prices at which actual business can be done. Whilst the association standard for joists and angles is £10, the current quotation is £9 10s., the basis being governed by the practice of outside firms. In some cases orders have been accepted at £9 7s. 6d., plus the usual charges for extras. In this department offers of Belgian steel are no longer being received, and if this continues, native firms may find their position a little strengthened. Very little structural material, however, is being called for at the moment, and some of the large contracting firms in the present state of their order books can see their way only to six or seven weeks ahead. Prices of bars continue to depreciate, and bars rolled from foreign billets can now be bought well under £9 15s. Lancashire producers state that they are able to obtain £10 5s. in the export market for bars rolled from English billets. Native mild steel billets are in poor demand at £7 12s. 6d. to £7 15s., but superior grade material is in better request. Makers of high carbon billets now quote £9 and £9 10s. Very little business is being done in imported semi-finished steel. The increased quotations of a week ago resulting from the belief in the further appreciation of the franc have not been maintained. It was possible this week to secure supplies at £6 15s. and even less, but so much foreign material was bought when prices were lower, that most firms in the Midlands have stocks to carry them on for several weeks. The Germans are making a bold bid for the cold rolled strip trade. This week they have offered supplies at £14 10s., which is £2 below the home price.

Staffordshire Iron Trade.

There is an improvement in the Staffordshire iron trade, and, though only a very slight one, it is none the less welcome. Whilst the call for forge iron is a trifle stronger than it was last week, buying is almost entirely confined to immediate requirements, resulting from the exhaustion of stocks which were grudgingly replenished a few weeks ago. In the tube trade a fair amount of activity is maintained, but makers are working very largely upon strip that has been made from re-rolled foreign billets. Renewed activity in the foundries has resulted from the resumption of work in the building trades, and this, together with the requirements of the makers of stoves and other winter goods, is rendering the foundries busier. Some of the Staffordshire makers of best bars are doing slightly better, but the improvement is not general. Merchant iron is still in poor request. Common bar mills have booked some orders for sizes 1¼in. and upwards, but demand for smaller sizes is very flat. Belgian shippers, who now quote in francs, want the equivalent of £8 2s. 6d. to £8 10s. for bars.

Galvanised Sheet Prices.

Export demand for galvanised sheets continues steady, whilst in the home trade there has been a slight improvement. The standard for 24-gauge f.o.b. is still £18 5s., but prices show increasing firmness. A specially heavy demand is being experienced for the thinner gauges, and some good bookings have been made for 30 gauges at £23 15s., an advance of 10s. per ton on recent prices.

Scrap.

The iron and steel scrap market remains unsatisfactory, and prices show little prospect of improving. Wrought iron scrap realises £4 15s. to £5, according to quality, delivered at stations. Heavy steel scrap is quoted at £4 to £4 2s. 6d., and steel turnings at £3 10s.

Foreign Iron and the Chain Industry.

Workers in the Black Country chain industry are bitterly complaining of the foreign iron which is being used in large quantities for the manufacture of chain. The men describe the material as "frozen iron," and complain that tests which have been made reveal the fact that there is much steel in the iron. They contend that as the chain has to be made at piecework rates, their task is rendered much harder by the inclusion of steel in the material, it being more difficult to obtain a satisfactory weld. It is asserted by the men that they are not able to produce as much chain from the foreign material as they can from the English iron, and they regard it indirectly as a reduction in their wages. They are asking for a conference with the Employers' Association for the purpose of discussing the whole subject, when it is likely that a proposal for an increase in the rates will be put forward.

Edge Tool Trade.

The edge tool trade in the Midlands and Staffordshire fails to achieve anything like stability in the character of its business. Recently a little more liveliness has characterised the market, but orders come in batches, one week being good, the next bad. On the whole, the trade cannot claim any permanent increase in business, but just a seasonal relief. Inquiries have been plentiful, but business does not mature in the same degree. Business for the home market yields very poor returns. It is not infrequently a case of accepting business at the bare cost of production as a means of filling up deficiencies left by the export demand. Competition between British makers is keen in overseas markets.

Cannock Chase Miners' Wages.

Miners in the Cannock Chase coalfield are, again this month, to have their wages reduced. The ascertainment of wages for the month of September shows that the reduction in a stallman's minimum daily wage will be 7d., his wages now being 10s. 6d. as against 11s. 1d. the previous month. This makes a reduction of 1s. 4d. during the past two months, and is attributed to the fact that the decrease in orders during the summer months has seriously affected the output. However, the prospects for the future, as I pointed out in my letter last week, are very bright, and the majority of the pits are now working full time.

The State of Employment.

A slight decrease in the number of unemployed in the Midlands is recorded by the Ministry of Labour, the total number being 147,731, as compared with 148,216 for the last weekly return. Compared with the total for a fortnight ago, however, there is a small increase, and the position in Birmingham is not so good as it was on the last report. In common with most industrial centres in the country, Birmingham is experiencing an increase in the amount of unemployment, and it is causing some concern. The grand total of unemployed and short-time workers is now 38,679, an increase on last week's figures of 2893. At Coventry also an increase is recorded, the figures having risen from 4047 to 4664. The increases are, however, regarded as merely seasonal, and are no reflex of industrial conditions which may be experienced in the winter. Indeed, in some quarters it is considered that the industrial outlook is steadier and brighter on the whole, although it is admitted there is not much to look forward to with any certainty.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Genera Conditions.

THERE have been some indications here that the iron and steel markets are slightly more hopeful than they were, although it cannot be said that any definite change has yet occurred. Recently there has been a little more buying by the merchants, and this may be taken to mean that in some quarters at any rate the feeling is better. There are, however, indications which point the other way, and particularly the failure of the Cleveland market to revive after the holiday week. The optimists naturally rely on the fact that the producing departments of the iron and steel trades are almost all working without profit, and hence that any further fall in prices is improbable. Of course, we have, in the past, seen prices continue to decline for a long time after all manufacturing profit had disappeared, and we may see such a condition again; but it may be admitted that in "profitless" times it is more difficult to get prices down, and that in the process some works and furnaces are bound to go out of operation.

Metals.

Although the market for copper has failed to make any progress after the slight improvement which was shown a fortnight ago, it seems possible that the general conditions are now more favourable for a rise than for a fall. No doubt the advantages expected from the settlement of the German trouble have been partially, if not fully, discounted, and it would be foolish to expect that Germany will immediately become a large customer for American copper. It will take time to bring the industries of that country back to a state of moderate prosperity, and meanwhile German consumption of copper will probably remain on the small side. What gives a better hope for the copper market is that, so far as can be ascertained, the output in America has been reduced to a certain extent, and that in the autumn some of the vast sums paid for the American harvests will find their way into the engineering and electrical trades of that country. In this case, while American production is being decreased, the rate of consumption may be increased. Of course, there are now no public statistics as to the actual position, and this is to be regretted, because it will certainly lead to wild guesses and a consequently more fluctuating market. It is curious how that idea of the advantages of concealment persists in the human mind, derived no doubt from the time when the savage individualist concealed his store of nuts and roots from his predatory neighbours. Buying of copper in the Manchester market has been on rather a small scale, and the consumer here is evidently not yet quite satisfied that it is safe to hold more than the most moderate stock of copper. Of course, the general engineering industry here is slack, and there is as yet no great necessity for buying metals. Dealers in old copper and gun-metal here do not show much confidence in the market, and as for the latter, the prices offered for it are still very low. Some dealers give only £46 per ton for good gun-metal scrap, while tin casts between £250 and £260 per ton, and refined ingots about £70. In the tin market there has been some wobbling back and forward, but there has been no definite movement yet. The values have kept up very well considering that buying for consumption has not been large for some time. Possibly the fact that the reserve stocks in the East are now so much reduced gives greater confidence to the market. Lead has kept fairly steady, and in Manchester the price has been round about £34 for some time. A slump in lead does not yet seem very near. Spelter has been a very steady market, and there has been some slight tendency towards higher prices.

Pig Iron.

The markets here for pig iron are quiet, but no worse than they were, and some people think that they are better. There was certainly a little more buying in the Midlands recently, but one cannot say that the foundry trade here is any different. As a rule consumers of foundry iron appear indifferent, and look for slightly lower prices, basing their ideas on the failure of the Cleveland market to recover after the holidays. Here in Manchester there may be a little more business, but there is nothing to justify any definite expectation of improved trade. The usual quotation for No. 3 Derbyshire iron has been 94s. per ton delivered in this district, but 93s. 6d. and even 93s. is heard of occasionally. Sellers of Lincolnshire iron seem inclined to press for orders at rather lower prices than those usually quoted for Derbyshire iron. There is also some Northamptonshire foundry iron on offer here, but it costs fully as much as the other makes owing to the high carriage. In fact, Northamptonshire iron would have to be sold below 80s. at the furnaces before it could make much way in the Manchester market. The demand here for Scotch iron is poor and cannot be expected to be large until the makers of textile machinery are busy again. About 108s. or perhaps in some cases 107s. per ton delivered is quoted here.

Finished Material.

There is no sign yet of any returning life in the markets for manufactured iron and steel. Iron in Lancashire, *i.e.*, the local make, is, of course, too dear, and that is all to be said about it. When the local works can bring their price for bar iron nearer to that for bar steel, then perhaps a larger market may be possible. There is some "best best" Belgian bar iron being offered here of special quality and perhaps worth consideration. The prices for manufactured steel do not show any change, and, in fact, they seem to have reached an "irreducible minimum," at any rate until the costs of production come down. Sellers of joists and angles quote £9 7s. 6d. per ton, and perhaps £9 5s. would be accepted. Flat steel bars are at £10 and common plates from £10 to £10 5s.

Scrap.

The demand for scrap is, of course, smaller now that so little business is being done in new material. Con-

sumers do not want much, and when they are ready to buy there are too many dealers ready to sell. This is particularly the case with regard to cast scrap, of which there is too much in the market. Apparently from 82s. 6d. to 87s. 6d. per ton are the usual prices quoted. For steel scrap there is now scarcely any market here. Dealers are in some cases paying 65s. on trucks, but many dealers now keep off the market unless they can buy at 60s. on trucks At this price it would be possible to find a market in South Wales. Heavy wrought scrap is supposed to be worth 90s. delivered, but one does not hear of any buying.

BARROW-IN-FURNESS.

Conditions Worse.

The stopping of the rail mills at Barrow means that unless there is an early re-start there will have to be a restriction in the output of iron. It is not politic to create stocks at the present time and over-production will be avoided. The amount of business in the hematite pig iron trade is small and the outlook is not bright at all. It would be difficult to discover an optimist in the local iron trade at the present time. There is a certain amount of trade in mixed Bessemer numbers, but no customer is taking big parcels; in fact, the tendency is to buy as little as possible and to refrain from placing any orders for forward delivery. The worst of it is, is that there does not appear to be a single ray of hope at the moment. The whole of the iron trade appears to be enveloped in a heavy fog, and from what direction the first glint of sun will come it is impossible to say. The continental and American trade is very poor and there are not many inquiries to deal with.

Iron Ore Quiet.

Naturally, with the iron trade under a cloud, the local ore market is dull and not hopeful. There is not much going out of the district and inquiries are limited to small parcels. As long as the iron trade continues to be quiet so will be the local ore trade. None of the mines are working at full strength, in fact some are doing but small business. Foreign ore is coming in in restricted quantities.

Steel.

For some weeks the local rail mills have been working from hand to mouth, and all the time it has been hoped that fresh orders would come to hand which would enable them to keep open, but they were forced to close down at the end of last week, and it is not known at the moment when they will re-start. Orders are not very frequent in the market in these days and competition for them is very keen. It might be possible to obtain some orders, but the price obtainable, instead of leaving a slight margin of profit, would involve a loss. The stoppage of the rail works at Barrow puts practically a thousand men idle.

Electricity Supply.

The Barrow Corporation is applying to the Electricity Commissioners for powers to supply the adjacent towns of Dalton and Ulverston with electricity, and there is some talk of the mains reaching Grange eventually. Already the Barrow power station supplies considerable electric energy to various works in the district, including the wire and small section mills, one or two ore mines, and the Barrow paper mills. The latter are very big customers and are likely to be greater. Neither Dalton nor Ulverston has any public electrical supply at present.

SHEFFIELD.

(From our own Correspondent.)

The Slump in Heavy Steel.

A DEPRESSED and depressing condition of things exists in the heavy steel trade of Sheffield and district—not merely at the three great works which are at a standstill owing to the strike, but at others engaged in the same trades. The billet section is in a state of slump. The works which continue manufacture, so far from booking larger orders as a result of the strike, are receiving instructions to suspend deliveries, and in some cases contracts are being cancelled. Irrespective of the thousands of men who are out on strike, the total number of unemployed has increased in the past month by more than a thousand, the bulk of whom are from East End works, where hands have been discharged and production reduced because of a general decline in orders. The position is nearly as bad in bar iron, pig iron, and steel rods as it is in billets. No great activity is expected in August, which is always the quietest month of the year, but this August is worse than last year's, and buying has fallen to an absolute minimum. The demand for wire, hot and cold rolled strip, has also dropped off, but this is only regarded as a seasonal condition, which may be rectified next month. Although the present picture is so cheerless, there are those who regard the future hopefully. It is believed that before long a substantial amount of employment will be forthcoming in engineering, shipbuilding and in constructional work of many kinds.

Good Orders for Tools.

The more satisfactory state of things in the lighter steel industries continues. Among makers of the finer steel and steel tools, many instances of fair activity are to be found. A better sale of the best high-speed tool steeds is reported. The various ferro-alloys used in the manufacture of these steels are being bought to an increasing extent, which indicates that the manufacturers have confidence in the continuance of the present improvement. For contractors', quarrying, building and engineering tools there is a steady demand on a considerable scale. Business is particularly good in spades and shovels, of which large quantities are being sent out. There has been some falling off in the demand for mining tools. It is encouraging to read that during the first six months of this year Sheffield sold to the United States more than 800,000 dollars' worth of steel, besides a large amount of other manufactured steel and iron products. The figure is not a very large one, but it shows that even high tariffs cannot keep Sheffield products out of America. It was found, soon after the passing of the Fordney Tariff, that the American steel makers put their prices up, with the result that the relative costs of the home-made products and Sheffield steels remained much the same as before.

July Steel Production.

Figures are now available with regard to the production of steel in July. They show that the Sheffield district produced 31,500 tons of acid, 39,500 tons of basic, and 3100 tons of Bessemer acid steel ingots. The total production of all kinds was 81,500 tons, which was 7000 tons in excess of June and 20,000 tons more than the figure of July, 1923. The Lincolnshire output of steel, 32,900 tons, showed declines of 2000 tons as compared with the previous month and of 8000 tons as against July last year. The pig iron production of Lincolnshire amounted to 59,100 tons, which was 1000 tons more than in the previous month and 8000 tons more than in the corresponding period of 1923.

The Cutlery Trade.

The improved condition of things in the cutlery trade is maintained, but progress is not rapid. Large quantities of stainless table knives are still being sold, and it is noted with satisfaction that a larger proportion of this trade is for articles of good quality, and the call for inferior sorts is declining. The departments turning out spring knives and scissors are rather better employed than they have been, but the razor branch is very depressed. Australia is still a very good market for Sheffield razors, and the houses trading with the Commonwealth have good business on hand. In other directions, however, the demand is very poor. It is questionable whether the trade will ever regain its old-time prosperity, owing to the hold which the safety razor has obtained. Some Sheffield firms have taken advantage of the change in fashion to set up the manufacture of safety razor blades, in which a large trade is done. The Army and Navy are at present requiring considerable quantities of cutlery and tools, and forms of tender are now out. The Admiralty wants 25,000 plated handled dinner knives and about 1000 cooks' knives and steels, besides reamers, hand vices, and other supplies.

Electro-plate and Silver.

The demand for good class silver and electro-plated hollow-ware continues only moderate. The catering trade sends out considerable orders periodically, and valuable services or cabinets are bought by well-to-do people for presentation purposes, but the ordinary household demand has fallen off to a large extent during the last few years. Nor is the trade in medium priced lines much better. It is in small and inexpensive goods, and in cheap case lines, that the greatest activity is seen. The production of the latter is probably on a greater scale than before the war, and the trade has been maintained at a high level for a long period. Several firms are devoting themselves specially to the satisfaction of these demands, and are producing goods of fair quality at low prices.

Progress at Thorne.

The latest news from Thorne Colliery, near Doncaster, where the Barnsley seam of coal was struck in No. 1 shaft a fortnight ago, shows that good progress is being made with the sinking operations in No. 2 shaft. A depth of over 200 yards has now been reached. The colliery company have informed the Thorne Rural Council that 2000 houses will be required, and that building operations will probably begin early next year. It is estimated that 250 houses a year will be built.

Shipbuilding at Hull.

A contract for the building of four vessels, each of 2500 tons deadweight, for the Eastern Steamship Company, Toronto, Canada, has been secured by Earle's Shipbuilding and Engineering Company, Hull. The order is welcome, as the shipbuilding industry of Hull has been very inactive for a considerable time. At Messrs. Earle's yard only one of the five slipways is occupied at present. The work on the new vessels will be started practically forthwith, and will keep the yard fully employed for at least seven months. The order was obtained in the face of very keen competition.

A Five Mile Water Main.

The laying of a new 30in. trunk water main through the city of Bradford has been in progress for some time, and at a meeting of the Water Committee last week the water engineer reported that the work had now been completed, the main had recently been charged with the normal working pressure of water, and had proved satisfactory in every way. The main is approximately five miles in length, and the pressure in it, at its lowest point, where it crosses the beck in Forster-square, is equal to about 226 lb. per square inch. The fact that not a single joint has proved defective, against such a high pressure, is a matter for congratulation. The Corporation has also laid a 12in. main for a distance of about 1000 yards from Killinghall-road, at a point opposite the Bradford Moor Barracks, to the junction of the old and new Leeds roads. This extension has provided additional work for men who would otherwise have been unemployed.

NORTH OF ENGLAND.

(From our own Correspondent.)

Gloom in Trade Circles.

THE trade outlook in the North of England grows more and more serious. The hopes entertained of a brisk opening out of the usual autumn business are still unrealised. True, anticipations were never extravagant, but there seemed to be some promise of improvement. The prospect has now rapidly changed, and an atmosphere of gloom prevails as to the future. The decrease in exports and the shortage of demands for the home market are producing a good deal of unemployment in the coalfields of Durham and Northumberland. Nor is there much prospect of improvement in sight. Whilst an increase in inquiries is reported from abroad, any revival in the overseas market is likely to be more than offset by decreased consumption by home industries. In addition to about 11,000 miners wholly unemployed in Northumberland and Durham, there are also some thousands working short time, in some cases only a couple of shifts a week. The position is also very discouraging in the iron and steel trades. Manufacturers are not only suffering from the slump in demand on home account, but they are also having to face considerable competition from European countries, and the scales are so heavily weighted against them that they are having to curtail outputs. Following upon the blowing out of a blast-furnace at the Ayresome Ironworks, Middlesbrough, last week, Gjers, Mills and Co., Limited, now announce that they have arrived at a decision to put their remaining furnace out of operation at the end of this week. This decision, which, it is stated, has been forced upon the firm by the continued depression in trade, means in effect the entire closing down of the works.

Iron and Steel Exports.

The foreign shipments of pig iron from the Cleveland district during August were the smallest which have been recorded for any month this year. To some extent the decline in foreign exports was compensated for by a bigger delivery to Scotland, but it is decidedly discouraging to observe that, whereas in May 48,264 tons of pig iron were shipped to foreign ports, only 11,464 tons were so shipped last month. Even that total would not have been reached but for the careful cultivation of new markets in South Africa and Australia. The steel trades reflect a slight improvement. There was more manufactured iron and steel shipped both coastwise and abroad, the total of 52,557 tons comparing with 41,162 tons in July and 47,982 tons in June. The Indian trade has suffered a severe contraction ever since the new import duties became operative, but the 7264 tons shipped to the South American Republics last month was, with one exception, the biggest monthly total recorded this year. Increased tonnages were also shipped to South Africa and Australia.

Iron and Steel Imports.

Returns issued this week by the Tees Conservancy Commission show the quantities of iron and steel imported to the river Tees from Holland, Belgium, France, Norway, Sweden, Germany, India, and coastwise for the ten months ending August 31st, as compared with the same months a year ago and the corresponding period of 1913–14. Pig iron brought in to the end of August totalled 19,441 tons, as against 11,094 tons a year ago, and 312 tons in the pre-war period; crude sheet bars, billets, blooms and slabs imported in the last ten months reached 71,111 tons, as compared with 60,351 tons a year ago and 33,646 tons in the pre-war period; and plates, bars, angles, rails, joists, &c., unloaded to the end of last month amounted to 16,091 tons, as against 10,315 tons a year ago and 19,441 tons in the pre-war period. There was a big increase in the import of pig iron during August, the total reaching 11,388 tons, as compared with 9163 tons in July and 627 tons in August, 1914.

Cleveland Iron Market.

The Cleveland pig iron market continues in a very depressed state. It is indeed very discouraging to find furnaces going out of blast, exports dwindling, and business generally restricted to quite small proportions. Still, the reduction of output will facilitate quicker recovery when the demand does come. It will arrest or at least retard the further accumulation of stocks of iron, and when consumption increases they should more readily be liquidated. There is not much foreign demand for Cleveland iron, but an improved move in the foreign exchanges would at once alter the position in favour of local makers. In the meantime Scotland is buying freely, and although there is ample room for improvement in the home trade, makers are resolutely retaining 83s. as their minimum figure for No. 3 Cleveland pig iron. No. 1 is firm at 88s., No. 4 foundry 82s., and No. 4 forge 81s.

Hematite Pig Iron.

The hematite pig iron trade is also experiencing a serious slump. The number of furnaces producing hematite has been reduced to fourteen, out of a total of forty-two operating on the North-East Coast. This number is ample, perhaps more than ample to meet current demand, and prices are still inclined to sag. The quotation for mixed numbers is now no more than 91s. 6d. per ton, and No. 1 is quoted at 92s.

Ironmaking Materials.

A state of utter stagnation still prevails in the foreign ore trade, and in the absence of any demand the price of best Rubio ore stands at 22s. 6d. per ton c.i.f. sellers. Good medium furnace coke is still quoted at 26s. per ton delivered at the works, but consumers are not inclined to pay that figure.

Manufactured Iron and Steel.

The manufactured iron and steel trade is having to face severe competition from continental makers, and a depressed demand at home. There is a large amount of cheap semi-steel coming into the district, and even some plates and angles. Makers under the circumstances do remarkably well to keep so much of their plant in operation, but it is a ceaseless struggle, and the outlook is discouraging. Prices are unchanged.

The Coal Trade.

The coal trade shows no signs of any recovery and the outlook at the moment remains cheerless. From all continental centres reports state that the markets are overstocked and that quiet times are likely to last a few weeks. There is a considerable amount of idle time at the pits in all northern areas, and the low prices, which are generally stated to be below production costs, have totally failed to stimulate the demand. The anticipated autumn demand, especially for gas coals, has not yet shown any signs of developing, and fitters have great difficulty in keeping pits working up to the recent average. Values generally show but little change.

SCOTLAND.

(From our own Correspondent.)

Clyde Shipbuilding.

THE Clyde output during August was comparatively good, and but for the fact that new orders have not been too plentiful of late, the outlook would be fair. Increasing costs are, however, against the placing of new contracts. At present the tonnage launched is greater than the tonnage being ordered, and in practically all departments of the shipyards and engine shops there is a surplus of labour. Employment, therefore, must soon suffer a decrease unless a fair addition is made to contracts on hand. The number of vessels launched during August reached a total of 15 of 48,683 tons aggregate tonnage, of which number one steamer accounted for almost one half. The Oronsay, twin-screw turbine steamer, 20,000 tons, built by John Brown and Co., Clydebank, for the Orient Steam Navigation Company, Limited, London. Chief among the other vessels launched were the following :—Baron MacLay, 6300 tons, for Hogarth and Sons, Glasgow ; Clan MacIlwraith, 5000 tons, for the Clan Line ; Bellaisla, 4560 tons ; and the Golden Cape, 4560 tons, for Wylie, Ross and Co., London. The most important contract reported during August was one for a passenger and cargo steamer of about 9600 tons, for the Indian service of the Anchor Line. The Coaster Construction Company, Montrose, will build three twin-screw steamers 230ft. in length, for the Pacific coasting service of the Union Steamship Company of British Columbia ; while Messrs. Yarrow, at Scotstoun, have been entrusted with the design and supervision of two torpedo boats which are to be built in Holland on behalf of the Netherlands Government.

Pig Iron Weak.

The poor demand for all descriptions of pig iron becomes more pronounced. Only some twenty-five furnaces are in blast compared with about eighty-five in normal times, but the output is easily sufficient for all requests. The nominal prices are unaltered, but easier terms have been quoted when a fair order was in prospect.

Steel and Iron.

The general appearance of the steel and iron markets is one of considerable dulness, and there are no indications of immediate improvement. Foreign competition is not so keen as it was, but its presence is still prominent enough to hamper new business to some extent. Consumers cannot be induced to purchase beyond their absolute minimum requirements, and current orders have been and are very limited. Ship-plates are a shade busier, but still far below normal, and sections are similarly placed. Black and ordinary galvanised sheets of the lighter gauges continue in strong demand for the foreign markets, and prices are fully maintained. Heavy steels are comparatively quiet. Business in bar iron has shown a little more movement, but the majority of the mills are still very inactive. Re-rolled steel is similarly placed.

Coal.

The Scotch coal market was inclined to dulness during the past week. Lanarkshire ells and splints, Fifeshire screened navigations and steams, and Lothians steams maintained a fair average, while treble nuts in all districts were strong. Other descriptions were inclined to weaken, and in the case of small sizes of nuts supplies were far in excess of demand, and considerable quantities were binged. Foreign buyers continue to purchase on a hand-to-mouth principle and almost entirely for prompt delivery, the prices quoted for forward delivery being higher than those exporters are disposed to pay. Aggregate shipments amounted to 280,387 tons, against 299,295 in the preceding week, and 323,101 tons in the same week last year. It has been reported that a Glasgow firm of exporters has received a contract for the supply of about 35,000 tons of steam coal—Scotch, option Durham—for shipment to Latvia for the State Railways. It was also mentioned that tenders have been forwarded for the Swedish State Railways' contract, at a price based on 20s. per ton f.o.b. for first-class Fife.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THERE has been no perceptible change in the conditions governing the steam and anthracite coal market as compared with a week ago. Considering the general state of trade, the majority of the collieries are in a fairly good position, though, of course, there are a number of undertakings which are entirely at a standstill and others which are working irregularly, with the result that a material quantity of various coals are off the market and prices are just about maintained. It cannot be said that there is real loading pressure at the docks, though as the outcome of arrivals of tonnage over last week-end, the docks presented a fairly busy appearance. At the beginning of this week six loading appliances were reported to be idle, but there were as many as 27 steamers awaiting their turn to take in cargo at the various ports of this Channel. Of this number 14 vessels were waiting at Cardiff. The outlook, however, does not afford much encouragement, as the demand from abroad is on a somewhat meagre scale, and the chartering of tonnage recently has not by any means been up to the average. In fact, chartering operations have lately been quiet, and this in itself is an unsatisfactory indication. It may be that this is caused by the gradual shortage of tonnage offering and the reluctance of owners to continue the employment of their vessels at rates of freight which are unremunerative. While it has been obvious that a good deal of tonnage is bound out westward, much of it is in ballast, in order to take advantage of the improved business offering homeward. The consequence is that, combined with the considerable amount of tonnage which has been laid up, it is quite within reason that before very long collieries will not have at their disposal such a good supply of tonnage as they have at present. There is already an improved tone about the freight market, more particularly for the Mediterranean, and the only factor that will operate to hold in check a rise in rates is the continued slackness in the foreign inquiry and the restriction in orders. At the same time the collieries will expect their contractors to place tonnage at their disposal in order to lift the coals which they have purchased, so that exporters will have to redouble their efforts to find an outlet for the coals which they hold. The risks attaching to c.i.f. business over the next month or so are fairly considerable, as coals cannot go lower in price and freight rates have about touched bottom, so that the prospects are that an improvement in the latter may be experienced, to the discomfiture of those who have based sales on the lowest figures recently ruling.

Coalfield Items.

There is to be a coalfield conference on the 16th inst., when a report on the position of South Wales under the National Agreement will be submitted by the Council of the South Wales Miners' Federation. Meantime the Federation leaders have declined to sign the new agreement. When the members of the Conciliation Joint Board for the coalfield met Mr. Evan Williams last week, the chairman of the owners' representatives spoke in a very discouraging way about the trade, and said that the position in this district was worse than it had ever been in the past. There were losses in 1922, but at no time in the history of the trade had there been such a serious loss as that which occurred in June last, and probably the position in July would be no better. Costs had increased by 2s. per ton in consequence of the increase in the minimum and the raising of the wages of the lower paid men to 8s. 0¼d. He added that nothing further must be done to increase the cost of working. The new agreement was likely to be more disastrous to the workmen than to the owners. There was the possibility that more collieries would have to close, bringing about more unemployment and irregular employment at those which continue to work.

Dry Dock Stoppage.

Inquiries in official quarters have failed to elicit than any move has been made to bring about a termination to the dispute which has resulted in a stoppage of work throughout the dry dock and engineering industry of this district, so far as the members of the Amalgamated Engineering Union are concerned. The whole of these particular workmen, along with the fitters' helpers and others, are at a standstill, but the employers are carrying on very well in the circumstances. It was thought that by this time the majority of the workmen employed in the industry would have been forced to a standstill, but such is not the case, although it is difficult to say exactly how many men are idle and how many are affected by the general quietness in orders apart from the trouble with the members of the Amalgamated Engineering Union. There were fears recently of an extension of labour troubles, inasmuch as a dispute arose between a few boilermakers and Mountstuart Dry Docks and Shearman's, Limited, with respect to the replacing of a few bottom plates on the steamship Le Coq, which steamer has been in dry dock at Cardiff for some time. After being opened for examination it was found that the vessel would require more repairs than were at first planned for, but before coming to a definite decision the owners wanted the steamer placed in wet dock for the purpose of carrying out a more exhaustive survey. The workmen, however, formed the conclusion that it was the intention of the owners to send the steamer to the Continent or elsewhere to have the further repairs effected and, therefore, declined to replace the bottom plates, with the result that the steamer could not be floated. A very serious position looked like developing, which would have involved the whole of the boilermakers in this district. The men asked for a guarantee that the whole of the repairs should be done in South Wales. The workmen's delegates met the representatives of the employers, and, after considerable negotiation, the matter was settled and the men returned to work unconditionally, but the work on the steamer is to be carried out locally. There will be work for a month on the vessel, which is in the hands of the Mountstuart Dry Docks and Shearman's, Limited.

New Coal Seam.

Last week the discovery was made of a new seam of coal at the South Rhondda Colliery, Brynna, Llanharran. Operations have been going on for several months, and the seam which has been found is 5ft. in thickness and of good quality.

Welsh Coalowner's Death.

The death took place on Monday night last of Mr. Thomas Taylor, J.P., of Pontypridd, who was seventy years of age, and had been identified with the South Wales coal industry for the greater part of his life. He was a native of Pontypridd, and was employed as a boy at the chain works there; but he was of an ambitious turn of mind, and after leaving the chain factory and improving his education, he started the Darran Ddu colliery level near Ynysybwll, which is now in operation, and is worked principally by his son. Subsequently the deceased sank a further pit at Energlyn, near Caerphilly, which for a few years were prosperous, but in 1913 the shaft was flooded out and was later closed. Despite his advancing years he commenced to sink what later came to be known as Taylor's Navigation Colliery, at Nantgarw. This was regarded as a highly speculative undertaking, but he overcame what to his friends and advisers were looked upon as insuperable difficulties. He committed himself to exceptional expenditure, but proved himself right in his judgment, and later sold the property to Messrs. Baldwins, Limited, for a considerable sum.

Current Business.

The tone of the steam coal market continues to be quiet, as the foreign inquiry does not materially expand. Superior grades of steam coal are very steady, principally brought about as the result of the suspension of work at the Cambrian collieries, but other qualities are no more than about upheld in price. Small coals are rather more plentiful. The anthracite coal market keeps a very good tone and collieries are well placed. Both large and sized coals are pretty well sold for this month, the only weak spot being for rubbly culm.

Miners' Wage Rate.

The wage certified as payable to miners this month is 20.72 per cent. on the 1915 standard rates, which compares with the percentage of 24.06 per cent. for August. The minimum provided under the wages agreement, viz., 42.22 per cent., on the 1915 standard rates will, therefore, have to be paid, and the cost will have to be borne by the owners, who will have to sacrifice the whole of their profits both standard and surplus.

Catalogues.

RUSTON AND HORNSBY, Limited, Lincoln.—Illustrated descriptive catalogue of class M oil engines.

THE COVENTRY CHAIN COMPANY, Limited, Coventry.—Booklet giving particulars of "The Coventry" chains for motor-cycles.

BLAKEBOROUGH AND SONS, Limited, Woodhouse Works, Brighouse, Yorks.—Illustrated catalogue No 81 dealing with gas valves and accessories.

CAMBRIDGE INSTRUMENT COMPANY, Limited, 45, Grosvenor-place, London, S.W. 1.—Illustrated folder discussing the firms "Easy-to-Read" thermometers.

JOHN WHITEHEAD AND CO., Limited, Albert Works, Preston.—Catalogue No. 132, fully illustrated, dealing with a wide variety of brick, tile and pipe machinery.

JAMES KEITH AND BLACKMAN CO., Limited, 27, Farringdon-avenue, London, E.C. 4.—Publication 157. Illustrated booklet describing the "K-B" laundry equipment.

WESTON CONCRETE ENGINEERING COMPANY, Limited, 2 Dean Farrar-street, Westminster, S.W. 1.—Illustrated booklet dealing with reinforcement for concrete roads.

THE LANSTON MONOTYPE CORPORATION, Limited, 43 and 44, Fetter-lane, London, E.C. 4.—Illustrated pamphlet dealing with the "Monotype" type, lead and rule caster.

HOWARD AND BULLOCK, Limited, Accrington.—Souvenir of the British Empire Exhibition : illustrated pamphlet describing the firm's revolving swift air-drying sizing machine.

THOMAS ALLAN AND SONS, Limited, Bonlea Foundry, Thornaby-on-Tees.—Illustrated catalogue No. 15 of flanged steam pipes and spigot and socket underground pipes for water.

HENRY WELLS OIL COMPANY, 11, Haymarket, London, S.W. 1.—Folder giving prices for "Germ Process" oils for industrial and marine work ; also folder dealing with the Argon engine oil.

KAYSER, ELLISON AND CO., Limited, Carlisle Works, Sheffield.—A pamphlet on special value steels, made with a new steel the chief property of which lies in its ability to retain its strength at high temperatures.

THE CONSOLIDATED PNEUMATIC TOOL COMPANY, Limited, Egyptian House, 170, Piccadilly, London, W. 1.—Illustrated pamphlet entitled "Quicker and Cheaper Riveting ;" also illustrated pamphlet dealing with the "Red Giant" pneumatic reamer.

JAMES SCARR, 19, Burnside-avenue, Sheffield.—Illustrated catalogue of braces, wrenches, pipe cutters, drills, reamers, pliers, hack saws and other small tools ; also leaflet illustrating type C bench drilling machine, and price list of carbon steel twist drills.

THE ENGLISH ELECTRIC COMPANY, Limited, Queen's House, Kingsway, London W.C. 2.—A new catalogue describing the "English Electric" Fullagar opposed-piston oil engine, with illustrations of various standard engines and important constructional details.

A CONVENTION OF RAILWAY ENGINEERS.—A convention of railway engineers has been arranged by the Association of German Engineers (V.D.I.) in conjunction with the Board of Direction of the German State Railways, and the meetings are to take place in Berlin from Monday, September 22nd, until Saturday the 27th. We understand that some 4000 engineers have announced their intention to attend the Convention, among which over 700 foreign guests are included. The Convention will open with a reception, which will be held at the Reichstag on the preceding Sunday evening at 7 o'clock. Papers which are to be read and discussed include reports by engineers of the American, Austrian, German, Swiss and Swedish Railways, and cover a wide range of subjects, from which we take the following. The transport of heavy goods and mineral ores, strengthening of bridges, concrete bridges, roller and ball bearings, improvements on locomotives, condensing locomotives, Diesel locomotives, suction gas locomotives, and electric locomotives, including the electrification of the Austrian, German, Swiss Railways. The latter part of the week will be devoted to papers on railway economy, signalling, repair workshop, and other similar subjects. On Wednesday, the 24th inst., a special visit will be made to Seddin Railway Station, near Berlin, where there is to be displayed a large number of the latest types of continental rolling stock and locomotives. Special braking tests are also to be carried out that day on a 90-axle corridor train, which will start for the Friedrichstrasse Station. Detailed information as to the programme may be obtained from the Secretary of the Convention at Ingenieurhaus, Berlin, N.W. 7, Sommerstrasse 4A.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	17/6 to 24/–
(1) Spanish	23/–
(1) N. African	23/–
N.E. COAST—	
Native	—
Foreign (c. ...)	22/–

PIG IRON.

	Home. £ s. d	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 16 3	—
No. 1 Foundry	4 18 9	—
No. 3 Foundry	4 13 9	—
N.E. COAST—		
Hematite Mixed Nos.	4 12 0	4 12 0
No. 1	4 12 6	4 12 6
Cleveland—		
No. 1	4 8 0	4 8 0
Silicious Iron	4 8 0	4 8 0
No. 3 G.M.B.	4 3 0	4 3 0
No. 4 Foundry	4 2 0	4 2 0
No. 4 Forge	4 1 0	4 1 0
Mottled	—	—
White	—	—
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	9 2 6	—
North Staffs. Forge	4 2 0	—
„ „ Foundry	4 10 0	—
(3) Northampton—		
Foundry No. 3	4 2 6	
„ Forge	3 17 0	—
(3) Derbyshire—		
No. 3 Foundry	4 5 0 to 4 7 6	
Forge	4 0 0	—
(3) Lincolnshire—		
No. 3 Foundry	4 10 0 to 4 12 6	—
No. 4 Forge	4 12 6 to 4 15 0	—
Basic	4 5 0 to 4 10 0	
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	{5 10 0 (a) / 5 15 0 (b)}	— / —

MANUFACTURED IRON.

	Home. £ s. d	Export. £ s. d.
SCOTLAND—		
Crown Bars	12 10 0	—
Best „	—	—
N.E COAST—		
Common Bars	12 10 0	—
LANCS —		
Crown Bars	13 0 0	—
Second Quality Bars	12 0 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	13 10 0	—
Best „	14 0 0	—
Hoops	15 0 0	—
MIDLANDS—		
Crown Bars	13 0 0	—
Marked Bars (Staffs.)	15 0 0	—
Nut and Bolt Bars	12 0 0	—
Gas Tube Strip	13 5 0	—

STEEL.

	(6) Home. £ s. d	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 10 0	—
Ship Plates, ¼in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ¼in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 10 0

STEEL (*continued*).

	Home. £ s. d	Export. £ s. d.
N.E. COAST—		
Ship Plates	9 15 0	—
Angles	10 0 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	13 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	9 10 0	—
Soft Billets	8 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 5 0†	—
Light „	9 10 0 to 10 0 0†	
Billets	8 10 0 to 12 0 0†	
MANCHESTER—		
Bars (Round)	10 5 0 to 10 15 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 0 0 to 10 5 0	—
„ (Lancs. Boiler)	13 10 0	—
SHEFFIELD—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	9 10 0	
Intermediate Basic	9 0 0	
Soft Basic	8 5 0 to 8 10 0	
Hoops	12 10 0 to 13 0 0	
Soft Wire Rods	11 0 0 to 11 10 0	
MIDLANDS—		
Small Rolled Bars	9 10 0 to 10 0 0	
Billets and Sheet-bars	7 12 6 to 7 15 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	18 5 0	—
Angles	9 10 0 to 10 0 0	
Joists	9 10 0 to 10 0 0	
Tees	10 10 0 to 11 0 0	
Bridge and Tank Plates	10 10 0	—
Boiler Plates	14 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	23/– to 23/3
Block Tin (cash)	260 15 0
„ (three months)	261 10 0
Copper (cash)	63 15 0
„ (three months)	64 15 0
Spanish Lead (cash)	33 5 0
„ (three months)	32 7 6
Spelter (cash)	33 5 0
„ (three months)	32 18 9
MANCHESTER—	
Copper, Best Selected Ingots	69 10 0
„ Electrolytic	70 10 0
„ Strong Sheets	94 0 0
„ Tubes (Basis price)	0 1 1½
Brass Tubes (Basis price)	0 1 0
„ Condenser	0 1 2½
Lead, English	35 10 0
„ Foreign	34 10 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8½ per lb.	
Ferro Tungsten	1/4½d. per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	8/–
„ 6 p.c. to 8 p.c. „	£23 10 0	7/9
„ 8 p.c. to 10 p.c. „	£23 0 0	7/6
„ Specially Refined		
„ Max. 2 p.c. carbon	£44 0 0	16/–
„ „ 1 p.c. „	£52 0 0	17/6
„ „ 0.75 p.c. carbon	£64 0 0	20/–
„ „ carbon free	1/5 per lb.	
Metallic Chromium	4/2 per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
„ Silicon, 45 p.c. to 50 p.c.	£12 2 6 unit	scale 5/– per
„ „ 75 p.c.	£18 0 0 unit	scale 6/– per
„ Vanadium	18/9 per lb.	
„ Molybdenum	8/2 per lb.	
„ Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£155	
Cobalt	10/9 per lb.	
Aluminium (per ton)	£130	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	18/9
„ „ Ell	20/–
„ „ Splint	21/9 to 24/–
„ „ Trebles	22/6
„ „ Doubles	18/3
„ „ Singles	15/9
AYRSHIRE—	
(f.o.b. Ports)—Steam	18/9
„ „ Splint	21/6
„ „ Trebles	22/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	16/– to 20/3
Screened Navigation	26/–
Trebles	24/–
Doubles	15/3
Singles	15/9
LOTHIANS—	
(f.o.b. Leith)—Best Steam	18/3
Secondary Steam	17/3
Trebles	23/3
Doubles	18/9
Singles	16/–

ENGLAND.

(8) N.W. COAST—	
Steams	28/6
Household	45/– to 58/4
Coke	33/6
NORTHUMBERLAND—	
Best Steams	20/– to 20/6
Second Steams	18/–
Steam Smalls	10/6
Unscreened	16/– to 17/–
Household	23/6 to 25/–
DURHAM—	
Best Gas	21/6 to 22/6
Second	18/6 to 19/–
Household	23/6 to 25/–
Foundry Coke	26/– to 26/6

	Inland.	
SHEFFIELD—		
Best Hand-picked Branch	32/– to 35/–	—
Barnsley Best Silkstone	26/– to 28/–	—
Derbyshire Best Brights	25/– to 27/–	—
„ „ House	23/– to 25/–	—
„ „ Large Nuts	21/– to 25/–	—
„ „ Small „	15/– to 17/6	—
Yorkshire Hards	21/6 to 22/6	—
Derbyshire „	21/– to 23/–	—
Rough Slacks	12/6 to 15/6	—
Nutty „	12/– to 14/–	—
Smalls	6/– to 9/6	—
Blast-furnace Coke (Inland)*	—	—
„ „ (Export)	f.o.b.	26/– to 27/–

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	29/6 to 29/–
Second „ „	27/– to 28/–
Best Dry Large	26/6 to 27/–
Ordinary Dry Large	25/– to 26/–
Best Black Vein Large	26/6 to 27/–
Western Valley „	25/– to 26/6
Best Eastern Valley Large	25/– to 26/–
Ordinary „ „	24/– to 25/–
Best Steam Smalls	17/– to 18/–
Ordinary „	14/6 to 16/6
Washed Nuts	25/– to 27/–
No. 3 Rhondda Large	27/– to 28/–
„ „ Smalls	20/– to 22/–
No. 2 „ Large	23/– to 24/–
„ „ Through	19/– to 21/–
„ „ Smalls	14/– to 16/–
Foundry Coke (export)	45/– to 52/6
Furnace Coke (export)	32/– to 35/–
Patent Fuel	27/– to 29/–
Pitwood (ex ship)	30/– to 31/–
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	52/6 to 55/–
Seconds	45/– to 47/6
Red Vein	33/– to 35/–
Machine-made Cobbles	57/6 to 60/–
Nuts	55/– to 62/6
Beans	40/– to 42/6
Peas	24/– to 26/–
Breaker Duff	11/– to 11/6
Rubbly Culm	12/6 to 13/–
Steam Coals:	
Large	23/– to 24/–
Seconds	22/– to 23/–
Smalls	14/– to 18/–
Cargo Through	18/– to 20/–

(1) Delivered (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* For blast furnaces only, 21/– to 25/–; open market, round about 24/– at ovens. † Latest quotations available. (a) Delivered Sheffield or Glasgow. (b) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

German Coal.

THE effect upon the British coal trade of the projected treaty of commerce with Germany may be easily over-estimated. Since the occupation of the Ruhr the quantities of fuel obtained from that country have been quite considerable, although nothing like the amount that was expected, and if to these consignments be added the deliveries of coal from the Saar it will be found that France has been well supplied with German fuel. Nevertheless, it does not appear as if there has been any falling off in the importation of coal from Great Britain. On the contrary, British coal imports have shown a tendency to expand. While the importation of coal has enormously increased, many of the collieries that were damaged or practically destroyed during the war have been put in working order and the total production is steadily creeping up to the pre-war figure. These heavy imports are due to the extraordinary progress of coal consumption, one cause of which is the retrocession of Alsace-Lorraine, which provinces are particularly dependent upon imported coal for their ironmaking and other industries. Elsewhere in France the industrial development has grown so considerably that the requirements in coal are much greater than they were before the war. The output of the French collieries cannot be increased to any appreciable extent, and has, indeed, been reduced by the operation of the eight hours' day. Owing to the thinness of the seams the use of mechanical coal cutters is possible only in a very few cases. The heavy increase in coal consumption can therefore only be met by the importation of fuel from abroad, and it is very doubtful whether Germany would be able to supply all that is needed, even if she had any interest in doing so, and in a treaty of commerce it is probable that France will provide more particularly for the supplying of German coal to Alsace-Lorraine. Apart from this fact, it is difficult to see how Germany can send sufficient coal on account of reparations to meet the increased industrial requirements all over the country. Fuel will still have to be procured from all possible sources of supply, and the only influence this will have upon the coal trade will be to cause a discrepancy in prices, such as exists at present, between the regions employing German coal and the western and southern departments where British coal is mainly used. This discrepancy is likely to become less marked as the result of inter-allied agreement with Germany, whereby a reasonable price will be fixed for the fuel supplied on account of reparations. The margin, therefore, may not be so great as to permit of German coal being distributed over a very wide area of territory in competition with fuel from other countries. Apart from the question of price, the inferior quality of most of the German coal creates a preference for British coal for steam raising, although this may be discounted in the future by the growing employment of pulverised coal, but British steam coal will continue to meet with a large demand, especially in the merchant marine, where it practically enjoys a monopoly. Although the French will not forego any opportunity of obtaining as much coal as they can from Germany on account of reparations, and are moreover aiming at reducing the national coal consumption by railway electrification and other means, there yet seems little to justify a fear that the forthcoming treaty of commerce will imperil the situation of the British coal trade with France. Nevertheless, there is no reason why a close watch should not be kept upon the negotiations.

Commercial Entente.

Another matter that is attracting some attention here is the possibility of an economic war arising out of Germany's recovering her commercial freedom at the beginning of next year. It is on account of this new situation that France is anxious to negotiate a treaty of commerce, and it is now suggested that as an era of economic strife seems to be opening up it may be advisable to reconstruct the Allied *entente* on a commercial basis. The idea is to enter into a general commercial treaty between the Allied countries with a view to checking any undue competition that may arise from the facilities offered to Germany to develop her trade. The suggestion is one that may meet with many objections, and it is mentioned here merely to show that the French are quite disposed, in view of the uncertain future, to consider an international commercial policy which will afford protection against the dumping of goods from Germany. Meanwhile the new French tariffs, which provide for a new classification of goods and the payment of import duties in gold francs, representing a considerable all-round increase, are being held up until something definite is known of early developments.

Foreign Trade.

The trade returns for the first seven months of the year show once again that with every depreciation of internal currency there is an increase in the values of goods exported, and in the latest figures there is an augmentation also in the quantities. These so largely inflate the total values that the values of exports exceed those of the imports, while the tonnage of exports is rather less than one-half the imports, this being due to the fact that the imports consist principally of raw material, while the exports are mainly manufactured goods. The import values totalled 22,972 million francs, an increase of 5681 million francs as compared with the first seven months of last year, and the exports were valued at 24,296 million francs, to which manufactured goods contributed 15,661 million francs, the total showing an increase on the year of 7734 million francs. So far as quantities were concerned, the imports amounted to 33,551,406 tons, an increase of 3,015,202 tons. Raw material accounted for 29,399,041 tons, and manufactured goods only contributed 851,791 tons. The exports, amounting to 16,034,628 tons, were 2,739,782 tons in excess of those of last year, and, of the total, manufactured goods represented 1,965,176 tons, an increase of 368,586 tons. It should be noted that the export values are fixed according to a definite Customs tariff, which is liable to be modified, while the values of imports are based upon the invoices accompanying them.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

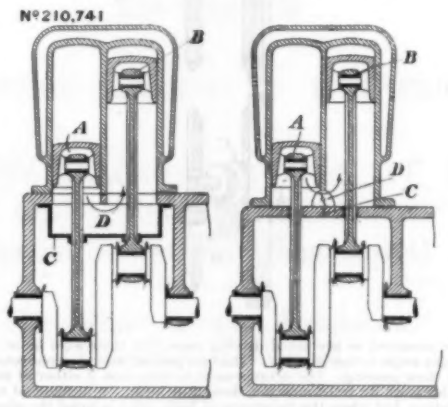
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

210,741. November 17th, 1923.—IMPROVEMENTS IN OR RELATING TO OIL-SAVING DEVICES FOR MULTI-CYLINDER ENGINES, PARTICULARLY INTERNAL COMBUSTION ENGINES, Professor Dr. Ing. Gabriel Becker, of 20, Stulenagelstrasse, Charlottenburg, Germany.

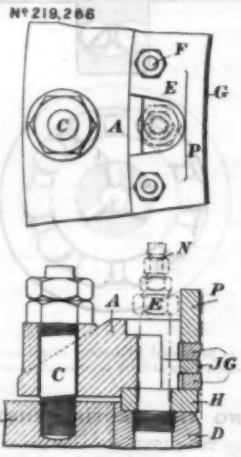
The object of this invention is to reduce the consumption of lubricating oil in light internal combustion engines. In the case of a multi-cylinder engine having oppositely moving pistons A and B chambers are formed at the open ends of the cylinders by introducing a slotted partition C, so that the air can pass in and out of the cylinders in communication without



the air passing to any substantial extent through the oil-laden air in the crank case. In the opening D between the two cylinders a disc valve or throttle may be placed to vary the amount of air passing, and a device for cooling the air may be fitted. The slotted partition may be formed by a tray placed within the crank case or alternatively by the top plate of the crank case itself as illustrated.—*July 24th*, 1924.

219,266. May 10th, 1924.—IMPROVEMENTS RELATING TO CYLINDER LINERS FOR INTERNAL COMBUSTION ENGINES, Palmer's Shipbuilding and Iron Company, Limited, and Daniel Kemp, of Hebburn-on-Tyne, Durham.

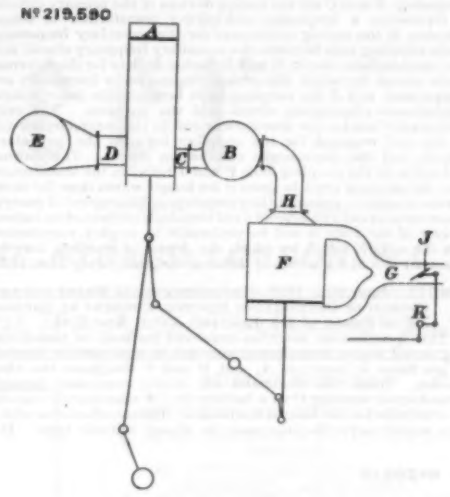
This invention relates to cylinder liners of internal-combustion engines, particularly the liners of opposed piston engines which are usually provided with detachable extensions fitted with scraping rings. A is the liner extension which is attached to the top of the cylinder B by the studs C. E is a separate junk ring fitted inside the liner extension A and secured to it by



studs F. The scraper rings G are disposed in an annular groove formed between the junk ring E and the usual bearing ring H, which is disposed between the extension A and the liner D. An inner ring J spaces the scraper rings. It will be seen that the junk ring E, the scraper rings G, and the inner ring J can readily be removed. These rings are slotted to allow them to pass the usual cylinder lubrication pipe shown dotted at N, and in the way of such slots an upstanding strengthening rib or projection P is provided.—*July 24th*, 1924.

219,590. January 9th, 1924.—REGULATING INTERNAL COMBUSTION ENGINES, Swan, Hunter and Wigham Richardson, Limited, Walker-on-Tyne, and P. L. Jones, 9, Rosebery-crescent, Newcastle-on-Tyne.

This invention is intended to enable internal combustion engines to run at exceptionally low speeds, without the temperature of the charge being too low for proper combustion. A is the working cylinder. B is the scavenge air trunk. C indicates the scavenge ports and D the exhaust ports, the latter leading to the exhaust trunk E. F is the scavenge pump to which air is led through the suction pipe G, the discharge into the scavenge air trunk B being through the discharge pipe H. The air supply is reduced at reduced engine speeds by means of the throttling valve J arranged in the suction pipe G, this valve being operated through the lever system K which is connected with a centrifugal or other governing device driven by the engine so that the throttle valve J will be operated automatically when the engine speed is reduced below the predetermined low speed. The rod may be connected to a fuel regulating lever so that, when the lever is put into a position corresponding to the load on the engine at which it is desirable to reduce the air supply per cycle, any

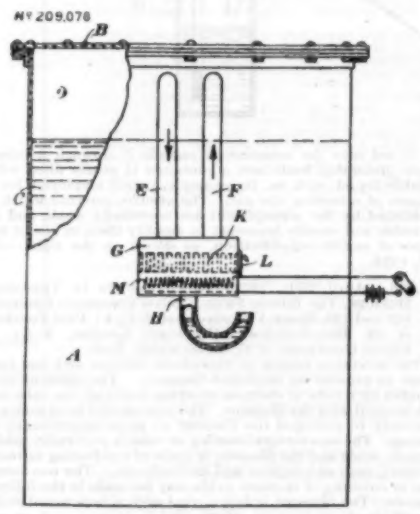


movement of the lever would cause a corresponding movement in the regulating or throttling valve J.—*July 31st*, 1924.

TRANSFORMERS AND CONVERTERS.

209,078. December 22nd, 1923.—IMPROVEMENTS IN OR RELATING TO TANKS FOR OIL-IMMERSED ELECTRICAL APPARATUS, *Metropolitan-Vickers Electrical Company, Limited, of 4, Central-buildings, Westminster.*

This invention relates to tanks for containing oil-immersed electrical apparatus, more particularly to means for providing an inert atmosphere in the space above the oil in such tanks. The transformer tank A is provided with the usual cover B and is filled with an insulating oil C, leaving a space D between the cover and the surface of the oil to allow of expansion of the oil. Tubes E and F opening into the space D are secured to a container or casing G having a breather pipe H filled with mercury or other liquid. The open end of this pipe communicates with

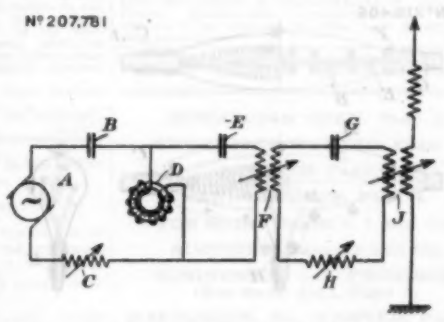


the outside air. Within the container G is the active material K which consists essentially of a layer of finely divided active metal or alloy intimately mixed with asbestos or other base material to provide a large surface area of the metal. Layers of asbestos constitute protective surfaces for the active mixture. Layers of gauze on the outside of the structure hold the layers in proper relation. The active mass K is inserted into the container G through an opening closed by cover L. A heating element M in the container is placed in relation to the active mass so as to be capable of heating it to a proper temperature for initiating and accelerating the oxidising reaction.—*July 31st*, 1924.

TELEGRAPHS AND TELEPHONES.

207,781. May 15th, 1923.—IMPROVEMENTS IN WIRELESS AND LIKE SIGNALLING, Walter Dornig, of 37, Fregestrasse, Berlin-Steglitz, Germany.

This invention relates in general to circuit arrangements for frequency multiplying transformers and particularly to arrangements of this kind used in wave or wireless transmission systems.

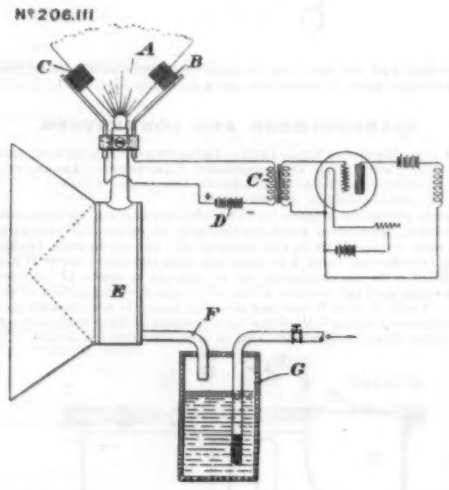


No producers of electric high frequency oscillations give waves of an ideal sine form. The current and voltage curves are all distorted more or less according to the type of the wave producers employed, so that a number of higher harmonic oscillations can be found besides the principal wave which the machine is really

intended to produce. The object of this invention is to suppress the undesirable collateral or upper harmonic waves. In the drawing A is the apparatus that generates the fundamental frequency, B and C are the tuning devices of the primary circuit, D represents a frequency multiplying transformer or transformers, E the tuning condensers for the secondary frequency, F the coupling coils between the secondary frequency circuit and the intermediate circuit, G and H tuning devices for the intermediate circuit by which disturbing frequencies or harmonics are suppressed, and J the coupling coils between the intermediate disturbance elimination circuit and the antenna. The only inductance besides the transformer coil in the secondary circuit is the coil required for the coupling between the secondary circuit and the disturbance elimination circuit. The mutual induction in the coupling coils F and J between the transformer and the antenna must be greater for longer waves than for short waves in order to transmit the greatest possible amount of energy. In order to avoid a number of fixed terminals connected to various points of the coils it will be preferable to employ variometers for the coils F and J by which the degree of coupling may be changed at will for waves of different lengths.—*July 31st*, 1924.

206,111. June 26th, 1923.—IMPROVEMENTS IN MEANS FOR AND METHOD OF CONTROLLING ELECTRIC CURRENT BY SOUNDS, Lee de Forest, of 318, East 48th-street, New York.

This specification describes improved methods of transforming sound waves into electric currents or modulations thereof. A gas flame is shown at A, and B and C designate two electrodes. These two electrodes are shown connected through transformer winding C to a battery D. A manometric capsule E is provided at the base of the burner. The membrane on which the sound waves impinge may be of any suitable type. The



gas is fed into the manometric capsule E through a tube F, which preferably leads into a container G nearly filled with a suitable liquid such as, for example, petrol employed for the purpose of enriching the gas. The electric currents which are modulated by the arrangement are necessarily weak, and it is advisable and usually necessary to amplify them in one or more stages of audion amplification, as shown on the right.—*July 31st*, 1924.

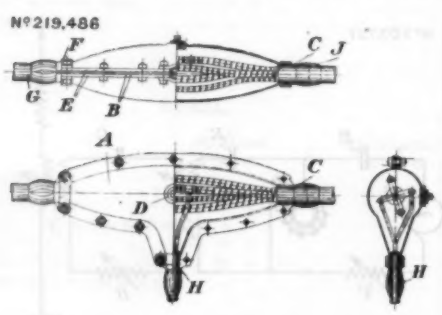
219,396. April 25th, 1923.—IMPROVEMENTS IN THERMIONIC DEVICES, The Edison Swan Electric Company, Limited, of 123 and 125, Queen Victoria-street, E.C. 4; Paul Freedman, of 59, Beresford-road, Highbury, London, N. 5; and Ernest Greetham, of 27, Louis-street, Hull.

This invention relates to thermionic devices and has for its object to provide an improved filament. The filament is surrounded by a tube of electron emitting material, the tube being non-integral with the filament. The tube should be of such a size as closely to surround the filament so as to approximate to a coating. The non-integral coating or tube is preferably made of thorium oxide and the filament is made of conducting refractory material, such as tungsten and molybdenum. The non-integral tube or covering of thorium oxide may be made in the following manner. The filament is first coated with a base metal such as copper by electrolysis or other suitable process, and an outer coating of thorium oxide is then applied to this copper coating or deposit. This outer coating of thorium oxide may be applied electrolytically by using an electrolyte consisting of an alcoholic solution of thorium nitrate and sodium chloride containing 80 per cent. by volume of a saturated alcoholic solution of thorium nitrate to which is added 20 per cent. of a saturated alcoholic solution of sodium chloride. In this electrolytic process the filament is made the cathode and during electrolysis the cathode is separated from the anode by a porous pot. The inner coating or deposition of copper is subsequently removed by electrolysis or any other suitable process.—*July 25th*, 1924.

TRANSMISSION OF POWER.

219,486. July 23rd, 1923.—AN IMPROVED JOINT BOX FOR MAKING JOINTS OF ELECTRIC CABLES, W. T. Glover and Co., Limited, of Trafford Park, Manchester, and Charles James Beaver, of Rangemoor Crescent-road, Hale, Chester.

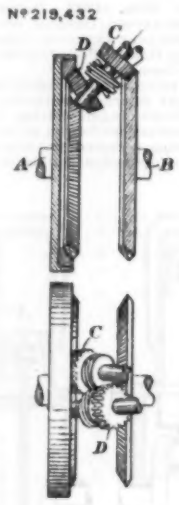
The box is composed of a shell made of lead or other ductile metal pressed into the required shape from sheet form and is



strengthened by hard metal supports. It is made in two parts or sections with outwardly projecting flanges at the edges of each half or section through which there are holes to receive the bolts. The drawings show a joint box made according to this invention. A is the main body of the box, B the flange or flanges, C is the extension and D the plugged inlet for introducing the compound. E are rigid metal bars conforming to the shape of the flanges and F metal clamps conforming to the shape of the tubular glands. G is the supply cable and H the distributing cable. J is the plumbed connection. A joint box constructed with parts as described can be made lighter and cheaper than ordinary joint boxes, and by means of the arrangement of steel straps, clamps, bolts and nuts the impinging lead surfaces can be pressed together and made water-tight without plumbing, though it is necessary to plumb the two sections of each of the tubular glands (including those of the box in the immediate neighbourhood) and to plumb the glands to the cable.—*July 31st*, 1924.

219,432. May 15th, 1923.—DIFFERENTIAL GEARS, D. Turnbull and A. T. Withers, 210, Villa-street, Lozells, Birmingham.

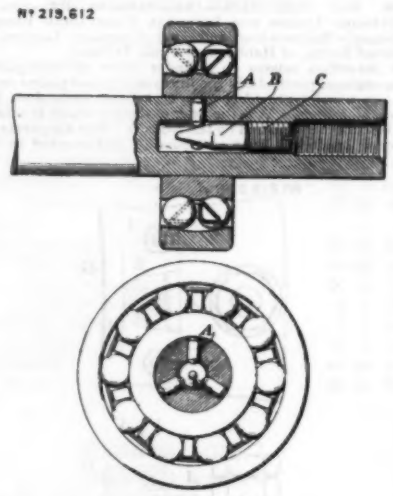
This differential gear is intended to function normally when the resistance of both road wheels is equal, but to lock automatically if either wheel tends to spin. A and B are the two half axles connected with the road wheels. A is fitted with an internally toothed crown bevel wheel, while B has an externally toothed wheel. Two pinions C and D mesh with the larger wheels and



are mounted in the usual driving cage, but their axes lie at a slight angle to one another. The two pinions are interconnected by skew gearing. The arrangement is such that if either of the axles loses its resistance the skew gear locks, on account of its friction, but when the resistance of both axles is equal the skew gear can move and differential action will be provided.—*July 31st*, 1924.

219,612. March 4th, 1924.—BALL BEARINGS, *W. Fairweather*, 29, *St. Vincent-place, Glasgow*.

The inventors propose to secure the inner races of ball bearings on their shafts by means of forcing outwards against the bore of the race pegs A A arranged in radial holes in the shaft. The

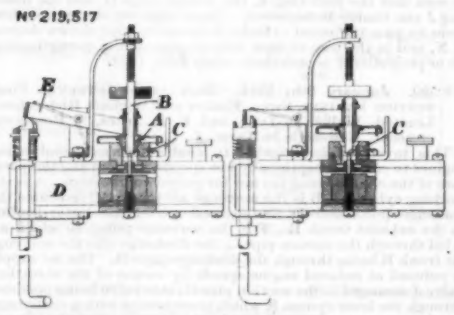


necessary force is provided by means of a loose conical member B, which is pressed forward by a separate screw C.—*July 31st*, 1924.

MEASURING AND TESTING INSTRUMENTS.

219,517. August 29th, 1923.—IMPROVEMENTS IN ELECTRICITY METERS, Measurement, Limited, and Frank Holden, both of Fitzalan-street Works, Kennington-road, London, S.E. 11.

This invention relates to electricity meters of the mercury motor type, with particular reference to the means adopted for



sealing the mercury chamber at that point where the armature spindle passes into the chamber, so that the apparatus may be safely transported from place to place while at the same time being ready for immediate installation and use. The improved sealing device is formed with a conoid or tapered or other plug A adapted to surround the armature spindle B in such a manner that it may be entered into the aperture in the fitting C of the mercury chamber D for the purpose of sealing the mercury chamber. It is withdrawn from the fitting (as shown on the right) by a cam-operated lever E when the meter is to be put into operation.—*July 31st*, 1924.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

THURSDAY AND FRIDAY, SEPTEMBER 4TH AND 5TH.

IRON AND STEEL INSTITUTE.—British Empire Exhibition, Wembley. Autumn meeting. For programme see page 104.

FRIDAY TO SATURDAY, SEPTEMBER 5TH TO 27TH.

MACHINE TOOL AND ENGINEERING EXHIBITION.—At Olympia, 10.30 a.m. (10 a.m. Saturdays).

SATURDAY, SEPTEMBER 6TH.

INSTITUTE OF BRITISH FOUNDRYMEN.—Visit to the Grappenhall Works of the Richmond Gas Stove and Meter Company, Limited, near Warrington. 3.15 p.m.

MONDAY TO THURSDAY, SEPTEMBER 8TH TO 11TH.

INSTITUTE OF METALS.—Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1. Autumn meeting. For programme see page 132.

TUESDAY, SEPTEMBER 9TH.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, London, E. 1. "The Measurement of Pressure," by Mr. J. L. Hodgson. 6.30 p.m.

SATURDAY, SEPTEMBER 13TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Public Library, Graham-road, Great Malvern. West Midland District meeting. 11.30 a.m.

MONDAY, SEPTEMBER 15TH.

BRITISH EMPIRE EXHIBITION.—Conference Hall No. 3. Conference of Engineering Societies. Papers: "The Working of Stainless Steel," by Miss C. Griffiths; "Co-operation between the Works Chemist and the Engineer," by Mr. A. R. Page; "Ceylon Plumbago—its Uses and High Qualities," by Mr. T. G. Hunter; "Technical Popular Fallacies," by Mr. A. S. E. Ackermann. 10.30 a.m.

TUESDAY AND WEDNESDAY, SEPTEMBER 16TH AND 17TH.

INSTITUTION OF PUBLIC LIGHTING ENGINEERS AND SUPERINTENDENTS. Annual meeting in Glasgow. For programme see page 181.

THURSDAY, SEPTEMBER 18TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Town Hall, Mansfield. East Midland District meeting. 10.30 a.m.

TUESDAY, SEPTEMBER 23RD.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, London, E. 1. "An Engineer's Life in Eastern Oilfields," by Mr. E. B. Seymour Norton. 6.30 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE CAXTON NAME PLATE MANUFACTURING COMPANY announces that it has recently changed its address from Caxton House, Westminster, to 11, 13, and 15, Rochester-row, Westminster, London, S.W. 1.

THE JONES AND LAMSON MACHINE COMPANY asks us to announce that owing to the re-numbering of Water-lane the new number of its offices has been changed from 9 and 10 to 19 and 21, Water-lane, London, E.C. 4.

BATES AND WINDIBANK, distributors for London and the South of England for F. and A. Parkinson, Limited, and Flather and Co., Limited, have removed from Sentinel House, Southampton-row, W.C. 1, to 140, Southwark-street, S.E. 1.

MR. J. V. LEVETT, A.M.I. Mech. E., A.M.I.E.E., has resigned his position as works engineer to A. C. Cars, Limited, Thames Ditton, having been appointed electrical engineer to Thos. Broadbent and Sons, Limited, Central Ironworks, Huddersfield.

RICHARD JOHNSON, CLAPHAM AND MORRIS, Limited, ask us to announce that the firm's new offices at Jacem House, Trafford Park, Manchester, have now been opened. The telegraphic address, Metallicus, Manchester, will remain the same, and the telephone number is 1220 Trafford Park. For the convenience of local customers a show room and store is being retained at 24, Lever-street, with the old telephone number, Manchester Central 1120, and a private telephone line to Jacem House.

SUTCLIFFE BROS. AND BRYCE, Limited, Globe Works, Hyde, inform us that they have acquired and incorporated in their company the old-established boiler covering business of W. J. Hookey and Co., Limited, of Cardiff, and that Mr. W. J. Hookey has joined the board of Sutcliffe Bros. and Bryce, Limited, and will manage that branch of the business as heretofore. The address of the new branch will be Sutcliffe Bros. and Bryce, Limited, W. J. Hookey and Co., Branch, Hodges-row, Docks, Cardiff.

CONTRACTS.

THE MIRRLEES WATSON COMPANY, Limited, of Glasgow, has received an order for three surface condensers, complete with auxiliaries, in connection with the electrification of the Capetown Suburban Railways. Each condenser is designed to deal with 104,000 lb. of steam per hour from a 10,000-kilowatt turbo-alternator set.

THE ENGLISH ELECTRIC COMPANY, Limited, has secured from the Postmaster-General the contract for the rolling stock and complete electrification of the Post Office Tube Railway. The equipment will be made at the English Electric Company's traction works at Preston, better known as the Dick Kerr Traction Works.